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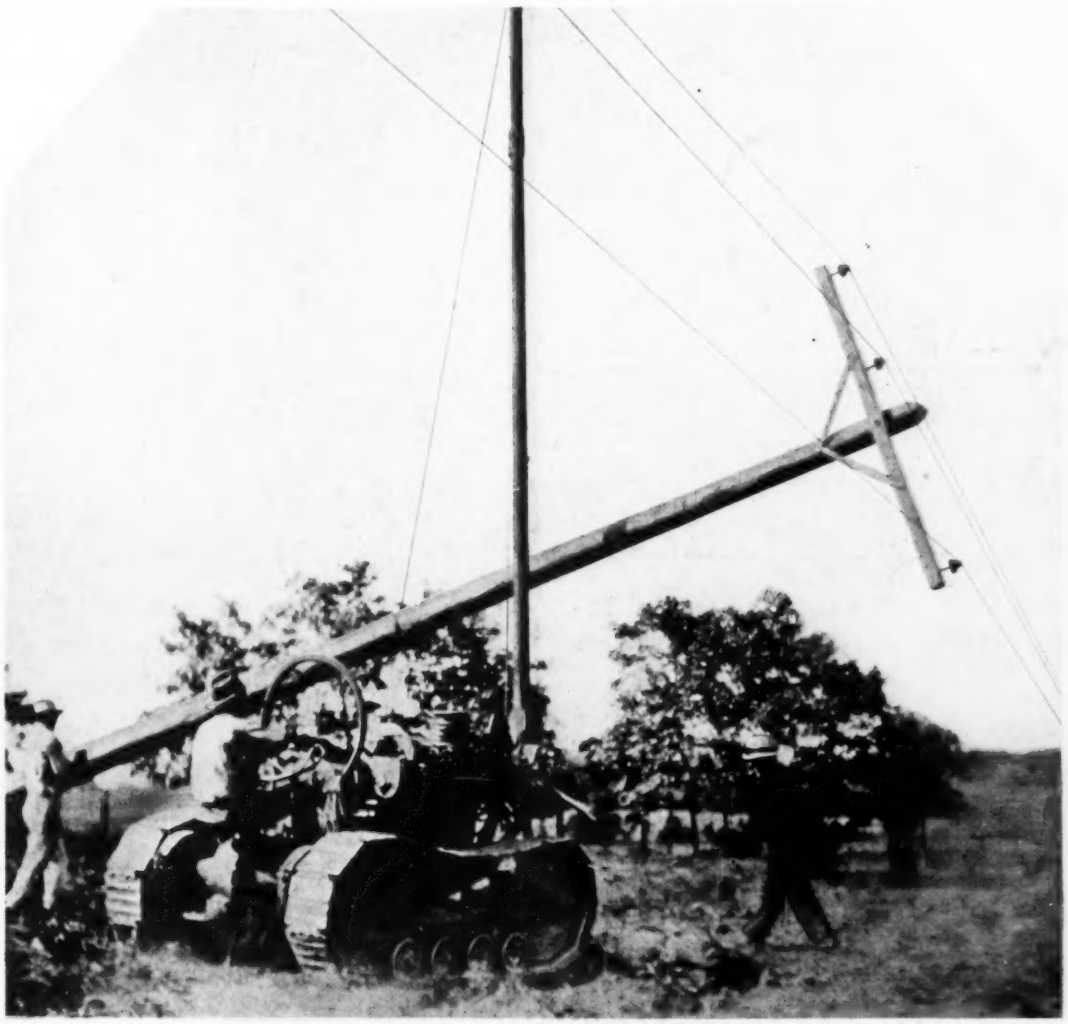

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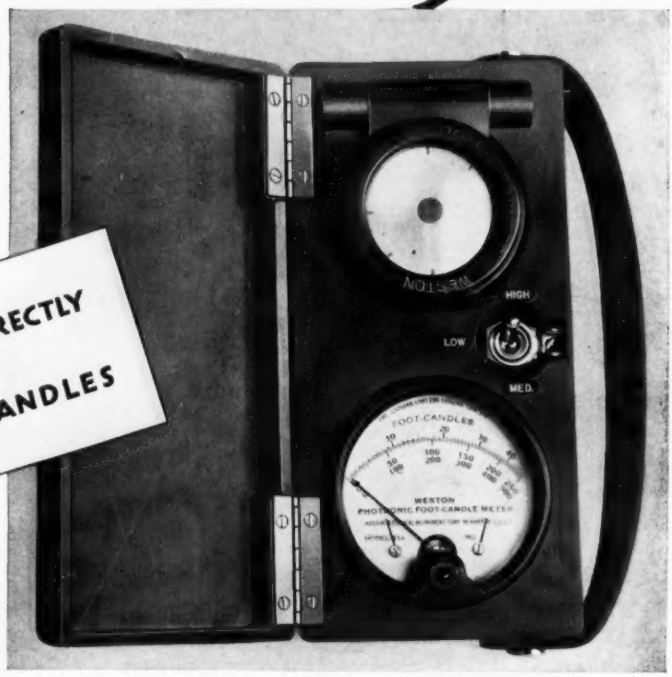

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ELECTRICAL WORLD

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for the Week Ending

July 23, 1932

St. Lawrence Treaty Signed

AFTER eleven years of agitation and several years of negotiation a treaty has been signed between the United States and Canada to govern the development of a seaway and 2,200,000 hp. of hydro on the St. Lawrence River. The treaty was signed on July 18, three days after the adjournment of Congress. Its ratification will wait on the December session and in the meantime there is to be an investigation by Senator Borah's foreign relations committee.

The treaty will be of far-reaching nature, designed to settle not only the development of the seaway to ocean vessels and the collateral development of hydro-electric power but many problems of navigation and the water level of the Great Lakes.

After the ratification legislation will be necessary to determine issues between the federal government and New York and other states; appropriations must also be made before construction can be started. In the face of all these uncertainties, officials would not attempt to predict when construction would begin.

The canal will conform to recommendations of the joint engineering board of the United States and Canada for a 30-ft. depth for permanent structures and 27-ft. navigation in the reaches. In distributing the cost, although the $800,000,000 estimated expense will be distributed equally between Canada and the United States, allowances for work each country has already done along the route will mean that Canada has somewhat less to pay in the future than the United States.

The provisions of the treaty involve principal features as follows:

Cost to be split

1. The United States and Canada will split equally the costs entailed, but each country will consider as contributions to the project such items of expenditure already made as those for the Welland and Sault Ste. Marie Canals, for channel clearing, dredging and like improvements on the direct routes.

2. Two dams across the St. Lawrence will be constructed; one structure being based on Barnhart Island, just north of Massena, St. Lawrence County, N. Y., and near Cornwall, Ont., and the other on Crysler Island, near Waddington, N. Y., and Morrisburg, Ont. The exact locations of the two structures will be left to the final engineering determination.

3. Electricity to be created, estimated at 2,000,000 hp., will be divided equally between United States and Canada, and legislation concerning its disposition, as well as claims of New York to riparian rights over production, will be left to the future determination of Congress.

The agreement to build two dams is a concession to Canada. American army engineers said one dam would be adequate and materially lower the cost. Canada insisted, however, on two dams. It was admitted that this extra dam will make the cost to New York proportionately higher and is one of the reasons why Governor Roosevelt has insisted that the state power authority be consulted.

After the treaty is signed and after its ratification by Congress legislation will be needed to determine the policy of the United States in its dealings with New York state concerning the power.

If the St. Lawrence project is made a campaign issue between candidates Hoover and Roosevelt, it will be well to bear in mind that one is the leading protagonist of subsidized internal navigation competing with the railroads and the other the leading protagonist of state ownership competition with electric power companies.

Another angle is the statement of Premier A. A. Taschereau of Quebec, who condemned the treaty for the following reasons:

1. It gives the United States 1,000,000 hp. when, if they were deprived of it, they would quickly come into the province and establish industries—as they have already done in Lake St. John and in the St. Maurice district in the eastern townships.

2. It will add millions of dollars to Canada's debt when her citizens are already heavily taxed, possibly more than they can bear.

3. This project gives the Province of Ontario 1,000,000 hp. on conditions infinitely superior to those of other provinces, seeing that this enormous quantity of power would go to the Ontario hydro, whereas our electric power companies are heavily taxed and the Dominion authorities have refused to put them on the same footings as the Ontario power system.

4. If this waterway ever became useful for navigation by seagoing vessels, severe competition would have to be faced by the railways, and the railways are now at the end of their tether.

Thus, the treaty appears to be but a steppingstone to long debates and not an indication of actual construction in the near future.

This Week

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Two States Halt Dividends to Holding Companies

Wisconsin and Alabama commissions have within the last week aimed a ruling directly at the heart of the relationship between holding companies and their operating subsidiaries. Wisconsin orders cessation of dividend payments on operating company common stocks held by holding companies and Alabama, in addition, stops payment of management fees.

No dividends are to be paid on common stock until the Wisconsin commission completes a formal investigation of the finances of the utilities and gives each company an opportunity to give reasons why a final order preventing the payment of dividends should not be issued.

The purpose of the order is to obviate the possibility that assets of the utilities might be drained off in the form of dividends. The commission contends that all revenues paid by Wisconsin consumers are necessary in preserving financial stability in the utilities and in protecting bond and preferred stockholders, as indicated by the following sections of the order:

If operating companies must now and for some time to come rely on their own resources to raise capital, those resources must be kept for local use, not dissipated for the benefit of public holders of uncontrolled and unregulated security issues by holding companies. If this is not done, consumers may one day find themselves served by a company with virtually all its equity capital wiped out or withdrawn.

The effect of this upon the company's capital costs and ability to maintain service standards, meet new demands for service at reasonable rates or make future rate reductions is obvious. This commission has a plain duty to do all in its power to prevent such injuries to consumers' interests in their rates and service.

The utilities receiving the order are: Commonwealth Power & Light Company, Wisconsin Power & Light Company, Wisconsin Hydro-Electric Company, Northern States Power Company, Interstate Power Company, Northern Power Company, Interstate Light & Power Company.

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Mitchell Dam Costs Slashed by Power Commission

Of the total claimed cost of $10,646,056.76 of the Mitchell Dam project to the Alabama Power Company, eight items aggregating nearly $4,000,000 have been scaled down to $282,133.04 by the Federal Power Commission in an order just issued. For a "fixed capital item not classified by prescribed accounts" in the claimed amount of $3,500,000 only $76,135.09 was allowed. A fee of $183,540 to the Dixie Construction Company was disallowed in its entirety. Electrical energy used during construction was scaled down from $72,788 to $30,660.

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Pinchot Asks Utilities Commissioner, Ill, to Resign

Governor Pinchot has demanded the resignation of Public Service Commissioner Emerson Collins of Williamsport, who for more than a year has been ill and, according to Mr. Pinchot, unable to perform his official duties. In a letter to Commissioner Collins the Governor asks his resignation, with the alternative of being confronted with charges of neglect of duty or inefficiency.

In the natural order of things, control of the commission will revert to the Governor within the next year, but Mr. Pinchot plans to dominate the commission before the next regular session of the Legislature or before the election of next fall.

The term of Commissioner Collins will expire July 1, 1933.

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Power District Election Called

The Oregon Hydro-Electric Commission has called for an election to be held August 9, 1932, by the taxpayers in Tillamook County to determine whether the organization of a public utility district is desired. The commission recommends that it would not be practicable for the taxpayers to proceed with the development of power until economic conditions improve to enable more favorable financing. It was also recommended that the properties of the private utility now serving the territory, the Mountain States Power Company, should first be acquired.

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Utilities Not Permitted to Absorb Power Tax

The Bureau of Internal Revenue has ruled that electric utilities, whether privately or municipally owned, may not absorb the new 3 per cent federal tax on domestic and commercial power. The bureau based its ruling upon the language of the revenue act, which provides that the tax for electrical energy furnished is "to be paid by the person paying for such electrical energy and to be collected by the vendor." If companies were allowed to absorb the tax for their customers the door would be opened to competition between companies on the differentials represented by absorbing or passing on the tax. Moreover, if municipal plants absorbed the tax this sum would be lost to the federal government as municipal revenues are not taxable.

Before the bureau made this ruling considerable confusion existed in the interpretation of the law, especially in the case of municipal plants, as shown by news items received from many scattered sources, which indicated they were planning to absorb the tax.

Officials of both the municipal light plant at Fort Wayne, Ind., and those of the Northern Indiana Public Service Company, a competitive company operating in the same city, have indicated that they will continue to absorb the 3 per cent tax in spite of the new ruling of the Bureau of Internal Revenue.

Officials of three South Carolina power companies refused to comply with a proposal made by the State Railroad Commission subsequent to a resolution passed by the Columbia City Council that they absorb the 3 per cent federal tax. They are the Broad River Power Company, Duke Power Company and Carolina Power & Light Company. This ruling of the Internal Revenue Bureau in Washington has the effect of setting aside the request of the state commission.

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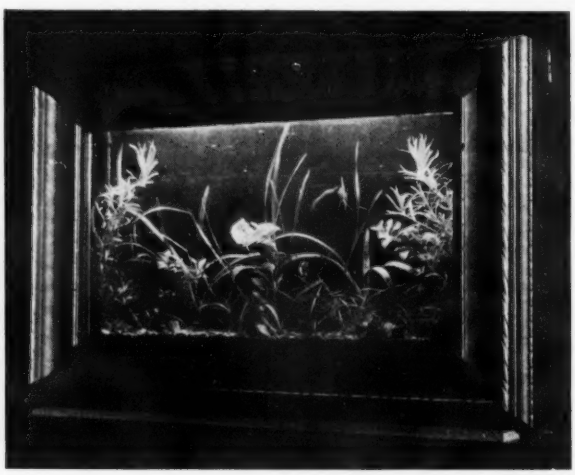
ILLUMINATED AQUARIUM REPLACES PISCATORIAL PAINTINGS

Aquariums, framed in picture molding, internally illuminated and set in the wall, offer new decorative mediums in the home. A. J. Sweet, at once Westinghouse illumination engineer and hobby aquarist, showed the possibilities at a meeting of the Newark Aquarium Society. Green filters over tubular lamps give the submarine touch.



No Bid on Maryland Utility

Following the offering of the properties of the Annapolis & Chesapeake Bay Power Company for sale at public auction at Annapolis, Md., on July 15, at which there were no bidders, the Consolidated Gas, Electric Light & Power Company of Baltimore filed a petition in the United States District Court, Baltimore, asking that the properties be offered again without a fixed minimum price. When the court permitted the sale of the properties by the receiver, Albert G. Towers, it was stated that any sale at less than a total of $3,750,000 would not be ratified by the court.

The Consolidated is the largest creditor of the company. The Annapolis & Chesapeake Bay Power Company is a subsidiary of the Washington, Baltimore & Annapolis Electric Railroad Company, also being operated by a receiver, and the Consolidated owns 54 per cent of the railroad company's stock.

Review of Nebraska Power Assessment Denied by Board

The Nebraska State Board of Taxation and Equalization and the Equalization Board of Douglas County have refused to review the assessed valuation of the property of the Nebraska Power Company as fixed in December last. Mark M. Shaw, publisher of a newspaper claimed to represent a statewide civic organization, had asked that the board take into consideration for purposes of review the testimony adduced at the hearings of the Federal Trade Commission showing what he claimed to be a much larger value for the property.

Believe It or Not

SEVERAL encouraging underlying factors point to better business conditions. These are, briefly:

1. Average index of stock prices has remained stationary for about seven weeks, with a turnover of only about 750,000 shares a day. This is a fair indication of a cessation of the strongest forces in liquidation.

2. The bond market has been getting better, with an indication of a re-entry of the individual investor into the market. This has encouraged plans for financing by industries and by utilities.

3. Commodity price levels are firm and rising, with special gains in hogs, cattle, coffee, rubber, cotton and other products.

4. The psychological effect of the Lausanne conference has been very encouraging and the settlement is expected to reflect itself in greater international business soon. Germany is after raw materials and will start manufacturing. Great Britain has cut its debt about one-third and has definite indications of British Empire prosperity.

These significant indicators can be placed against the bad influence of contracting bank credit and little gain in business to give a very favorable balance sheet for better business in the near future.

Power Commission for Federal Control

PUBLIC control of holding companies in the power utility field is "absolutely essential" to the public interest, the Federal Power Commission has concluded, according to a summary made public today of the exhaustive report, now in preparation, of the commission's investigation into hydro-electric interests licensed under the federal water-power act.

The commission found that ten "top companies" control as many groups of power utility groups serving 12,487 communities with a population in excess of 42,000,000. These ten groups, including 91 companies, are said to control 48 major power projects under license to public utilities.

"The companies of these groups," the preliminary report, a "foreword" to a 150-page unpublished report, states, "distribute over 49,000,000,000 kw.-hr. of current, of which 8,000,000,000 is received from the licensed plants already operating.

As to charges made for salaries

The commission recommends that public control over holding companies includes the "service organizations of these holding companies" with supervision of all contracts between holding companies and their operating companies, as well as "regulation of accounts, with requirements providing specifically for the filing of financial and other reports on prescribed forms for full publicity."

The study of holding company relationships was undertaken primarily for the purpose of instructing the commission on how to deal best with power licensees and touched hardly at all on the financial relationships between companies, the foreword states.

However, "the study disclosed," the commission said, "the dominance of the holding company in that portion of the power field covered by projects licensed under the federal water-power act." The foreword continues:

Even though the holding companies and their affiliated companies should grant to the Federal Power Commission free and unrestricted access to all of their records, the commission, in order to obtain information and data necessary for determining the cost of services furnished, or for passing upon the reasonableness and propriety of fees and charges for services, etc., or perhaps for passing upon the propriety of the services themselves, would, perforce, have to become involved in and consider matters and transactions not having direct relation to any licensee or to any licensed project.

It is the judgment of the power commission that public control should include in its scope the service organizations of these holding companies and would include regulation of accounts with requirements providing specifically for the filing of financial and other reports on prescribed forms with full publicity. Adequate public regulation also would include supervision of the issue of securities to the investing public.

How the ends of public control can best be attained may become better understood through the current Congressional investigation directed to all holding companies, but the general proposition seems to be already demonstrated that federal control of the holding company is absolutely essential to effective public regulation of the operating company. The Federal Power Commission is convinced, therefore, that the power of Congress should be invoked to the fullest extent possible in the enactment of legislation stopping these loopholes in public control of the electric public utilities.

The report stirred some political interest, because it emanates from an agency of the Hoover administration and makes some of the same recommendations which Governor Franklin D. Roosevelt of New York, Democratic nominee for President, has urged as an outgrowth of developments in connection with power interests in New York State. The report was looked upon in some quarters as likely to fend off charges which the Democratic candidate may make against the Administration on the issue of public control of water power.

Taxes Take 26 per Cent of Net

Out of its receipts for 1932 the Consolidated Gas, Electric Light & Power Company of Baltimore will be called upon to pay about $8,900 a day for taxes, including Sundays and holidays. The total estimated taxes for 1932 to be paid will be $3,250,000. In addition to the increased federal income tax, the company will have to pay other new federal taxes in substantial amount. Some of these items are at the rate of $13,200 a year additional for postage, $4,500 for additional 1-cent tax on gasoline, $2,500 for the new tax on checks issued by the company, etc. The company's 1932 total tax bill will take 26 per cent of the net earnings, before deduction for taxes, for the year.

Coming Meetings

Camp Co-operation XII—By boat to Bermuda, Aug. 3-8. Society for Electrical Development, 420 Lexington Ave., New York.

Wisconsin Utilities Association—Commercial section, Eau Claire, Wis., Aug. 25-26. John N. Cadby, 135 W. Wells St., Milwaukee, Wis.

American Institute of Electrical Engineers—Pacific Coast convention, Vancouver, B. C., Aug. 30-Sept. 2. Middle Eastern District Meeting, Baltimore, Md. Oct. 10-13. H. M. Henline, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-9. H. A. Buch, Telegraph Bldg., Harrisburg.

Rocky Mountain Division, N.E.L.A.—Stanley Hotel, Estes Park, Colo., Sept. 12-14. G. E. Lewis, 367 Gas & Electric Bldg., Denver.

Empire State Gas & Electric Association—Saranac Inn, N. Y., Sept. 22 and 23. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society—New Ocean House, Swampscott, Mass., Sept. 26-30. E. H. Hobbie, 29 W. 39th St., New York.

National Electrical Wholesalers Association—Hotel Statler, Buffalo, N. Y., Sept. 26-30. E. Donald Tolles, 165 Broadway, New York.

National Safety Council—Washington, D. C., Oct. 3-7. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Oct. 6-8. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists International—Kansas City, Mo., Oct. 10-12. L. W. Davis, 420 Lexington Ave., Nw York.

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R. M. Young Commissioner in Indiana

Ralph M. Young of Muncie, Ind., has been appointed a member of the Indiana Public Service Commission to succeed Frank T. Singleton of Martinsville, whose term has expired. Mr. Young has been chief of the motor vehicle department of the commission for nearly four years. He is a republican and the term is for four years. Mr. Singleton had been a member of the commission for eight years.

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Utility Loans Restricted by Massachusetts Board

Rules and regulations for lending of money by gas and electric companies have been drawn up by the Massachusetts Department of Public Utilities in the following form:

Temporary loans of surplus funds may be made by a gas or electric company for periods not exceeding one year, as follows:

1. To the United States of America and to the Commonwealth of Massachusetts.

2. To national banks and to trust companies and savings banks incorporated under the laws of the Commonwealth.

3. To municipalities in which such companies are engaged in the sale of gas or electricity in amounts not in excess of the amount of taxes assessed to such companies in such municipalities for the year preceding that in which such loans are made.

4. To an electric company engaged in the manufacture and distribution of electricity which, under the provisions of section 9a of Chapter 164 of the General Laws, has stated in its agreement of association that it is organized for, or that thereafter its corporate purpose shall be, the generating and buying of electricity and the transmitting and selling of the same to two or more corporations of which the corporation so lending its funds is one.

5. To officers, agents and employees of said companies in anticipation of their authorized expenses, not in excess of $1,000 to any such officer, agent or employee.

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Electric Investors to Dissolve

Electric Investors, Inc., has filed a certificate of dissolution with the New York Secretary of State. The assets of the company were absorbed by the Electric Bond & Share Company late in 1929 through an exchange offer involving eight shares of the latter for each five shares of Electric Investors common stock. The $6 preferred stock was exchanged on a share-for-share basis. Electric Investors, Inc., was organized December 1, 1924, by the consolidation of Electric Utilities Corporation with Electric Investors. The principal business of the company was to acquire for long-term investment securities of various kinds, especially the common stocks of progressive public utility companies. As of June 30, 1929, the company had total assets of $62,774,815.

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Cambridge Utility Reduces Rates

Appearing before the Department of Public Utilities on petition of certain customers of the Cambridge Electric Light Company, Wallace H. Walker, a customer, and not a paid counsel and not representing the Public Franchise League, stated that a compromise agreement had been reached with Attorney Dodge, representing the electric company, whereby a reduction in rates has been agreed upon. A new schedule was filed with the commission modifying several existing schedules and providing for reduction in rates of ½ cent per kilowatt-hour.

The new rates are as follows: Classification A, general lighting rate, reduced by ½ cent for the first 2,000 kw.-hr., lowering the charge from 5½ to 5 cents; the balance is reduced from 4½ to 4 cents. A-1 optional residential rate, which includes a fixed charge, plus an energy charge, fixed charge remains unchanged, but the other is reduced from 3 to 2½ cents. A-2, commercial charge, keeps the fixed rate unchanged, but reduces the energy charge by 2½ cents for the first 700 kw.-hr., or from 7½ to 5 cents.

The new rates, subject to approval of the commission, will become effective August 1, and on the basis of last year's business will result in a saving of $100,000 to customers in the Cambridge company's territory.

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Long Succeeds in Blocking Garsaud Appointment

The fight of anti-utility interests, led by Senator Long (Dem., La.) to block confirmation of Marcel Garsaud as a member of the Federal Power Commission proved successful when the Senate interstate commerce committee on Thursday decided not to attempt to vote out his name. The nomination will be considered again at the first meeting of the committee when the December session of Congress opens.

President Hoover will probably give Garsaud a recess appointment so that he may continue his duties with the commission, but without pay, until the Senate acts.

The excuse given for putting over consideration of the nomination was that certain members of the committee had not been able to familiarize themselves with the evidence presented by Charles A. Russell as to the handling of the Lockport case. Apparently this was true enough with respect to two or three members of the committee. Certain other members of the committee apparently would like to hold the place open so that in the event of a Democratic victory this fall it could be filled by a nomination made by the new administration.

It is known that Franklin D. Roosevelt was much interested in the matter. Senator Huey P. Long, who led the opposition to Colonel Garsaud, telephoned Governor Roosevelt to send Mr. Russell to testify. Governor Roosevelt naturally would be interested in nominating for the commission a man of his own choice. Some think an effort is being made to hold the place open for Mr. Russell.

The action of the committee came as a distinct surprise even to many of its members. It was known that Colonel Garsaud had made a very favorable impression on even the Progressives who are members of the committee. For that reason it is concluded very generally that the action taken was influenced by political expediency, rather than the merits of the case as revealed to the committee by the testimony.

Much of the vigor in the opposition dates back to a local political feud between Long and Garsaud when the former as Governor of Louisiana tried to force the New Orleans Dock Board, of which the latter was a member, to "throw" a lucrative insurance contract where Long wanted to see it go. Garsaud was removed later from the board and the contract then went where Long wanted it to go.

Associated System Relinquishes Rochester, but Holds Firm Elsewhere

THREE rapid developments marked the career of the Associated Gas & Electric Company during the past week. Rochester Gas & Electric Company appears to have reverted to control of Rochester interests, General Gas & Electric Corporation is threatened with forced receivership and the Associated system has made a new plea that its 250,000 security holders invest an average of another $100 apiece to meet an "imperative necessity."

In return for aid in meeting the July 15 maturity of $9,060,000 of 3 per cent notes a group of Rochester and New York bankers will have three out of four voting trustees under a proposed voting trust agreement, only one to represent the Associated system.

General Gas insolvency charged

A suit requesting the appointment of receivers for the General Gas & Electric Corporation, controlled by the Associated Gas & Electric Company, with headquarters in New York, was filed in the Court of Chancery in Maryland by two stockholders, the General Utilities & Operating Company of Baltimore and Frank R. Kent, a Baltimore political writer.

A protective committee has been formed by Frank B. Cahn and Walter H. Buck of Baltimore and Joseph Glass of New York for the General Gas & Electric preferred stock.

Subsidiaries pressed, parent undismayed

Meanwhile security holders of the Associated Gas & Electric Company have received from the company a statement asserting that the company "has no bank loans and that no voting or equity stocks of any operating subsidiary or of any holding company of the system have been pledged for any bank loans or any other short-term debt."

Though the company has virtually halved the $35,203,000 current debt outstanding last February, the company says it is faced with imperative necessity of raising $18,556,000 promptly to meet outstanding short-term notes of operating subsidiaries principally held by banks and corporations throughout the country. These are:

Staten Island Edison Corporation	$1,936,000
Rochester Gas & Electric Corporation	9,060,000
Pennsylvania Electric Company	7,560,000

At the start of the year the requirements of the system for 1932 were:

Notes payable	$9,343,928
Purchase-money obligations	3,190,153
Operating company maturities	26,987,500
Affiliates' maturities	2,382,000
Total	$41,903,581

The Associated Gas & Electric Company itself had $2,990,153 purchase money obligations and $7,450,000 unsecured notes payable at the end of 1931. The entire $10,440,153 had been paid off by May 20, 1932.

With the Rochester issue out of the way for the time being and with new bonds for that company authorized by the Public Service Commission to replace its new bank loan, the Associated company shows only $1,936,000 Staten Island and $7,560,000 Pennsylvania Electric notes to be met outside of the maturity of the General Gas & Electric Corporation, which has been substantially reduced below the $1,826,000 figure named. In all, about $12,000,000 is still required by the system to complete its refinancing.

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Irving Trust Receiver for Insull Eastern Group

Efforts to preserve the Middle West Utilities stake of $40,000,000 in the $600,000,000 Insull Eastern properties represented by the National Electric Power, National Public Service and Seaboard Public Service companies have come to a halt. Charles A. McCulloch, receiver also of the Middle West company, has resigned, along with Messrs. Auchincloss and Anderson, as receiver for the National companies after eight days of service (see ELECTRICAL WORLD, July 9, page 33). Irving Trust Company of New York has been appointed receiver for the National and Seaboard units.

Conferences indicated that there was no basis for a plan to keep the holding companies under equity receivership until reorganization could be effected. Free assets are lacking and receipts from the operating companies would be insufficient to justify hopeful prospects of reorganization measures. On this point the Chicago receivers differed with the five banks in New York which hold as collateral for loans the stocks of practically all the operating companies in the National group. The banks had been preparing to sell this collateral at auction and assume control of the National directorate, but it is understood this has been postponed.

Officials of the subsidiary companies conferred in New York last week, but no announcement has been made concerning the method of co-ordinating the functioning of these companies under a staff representing the holding company receiver.

An independent committee has been formed to represent holders of the National Electric Power Company's secured debenture 5s of 1978 and it questions the propriety of a committee formed on July 3 because of the participation in it of groups who took part in the debenture financing.

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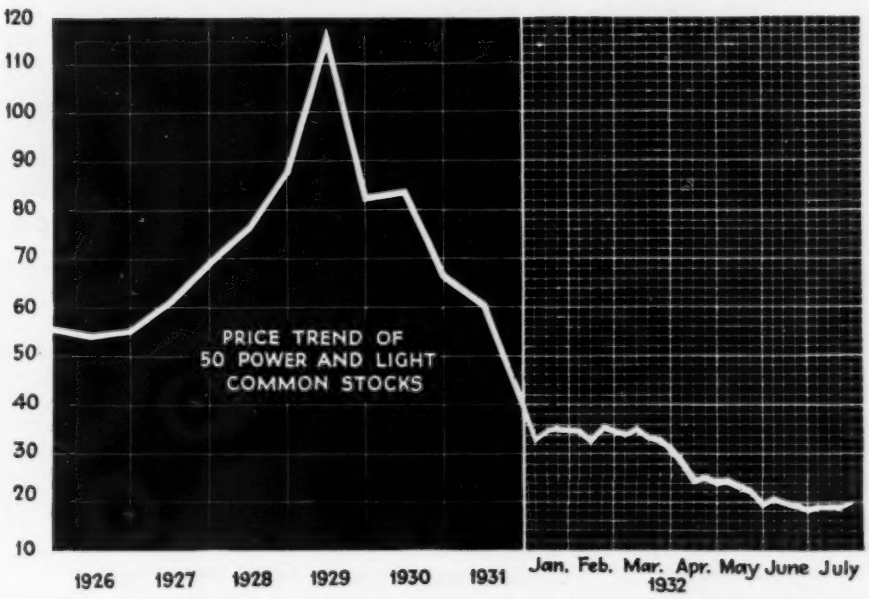
Utility Stocks Continue Advance



The upward trend in the prices of electric light and power stocks noted last week continued during the past few days. Some issues advanced from one to five points, gains being sufficient to carry the "Electrical World" index from 19.1 to 19.9.

Westinghouse Orders Total $20,343,216

Westinghouse Electric & Manufacturing Company reports orders received in the quarter ended June 30 as $20,343,216, compared with $20,388,658 in the quarter ended March 31, a total of $40,731,874 in the six months ended June 30. Sales billed in the second quarter were $21,014,770, compared with $20,377,948 in the first quarter, a total of $41,392,718 in the six months ended June 30.

Constructive economies to reduce indirect expense initiated by the company during the past two years have resulted in monthly savings exceeding $3,400,000, and the full effect of this program of economy has not yet been realized. The volume of new business has been so small during the past six months that the company operated at a loss notwithstanding these economies. In the three months ended June 30 the loss, $1,881,979, compared with a loss of $1,320,148 in the three months ended March 31, a total loss of $3,202,127 for the six months ended June 30.

The balance sheet at June 30 showed the company was in a strong position as to cash and other current assets. On that date current assets were $94,024,736 and current liabilities were $5,780,668, indicating a net working capital of $88,244,068. The company has outstanding no bank loans, no notes and no bonds.

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New Utility Issues Quickly Absorbed

The offering and prompt sale last week of public utility issues totaling $70,000,000 was hailed in financial circles as the forerunner of extensive new financing. It is expected that companies which have been waiting for a receptive market will take advantage of the improved conditions.

The success which attended the new offerings was a direct result of the uninterrupted improvement in bond prices on the Stock Exchange. The Brooklyn Union Gas Company and the Edison Electric Illuminating Company of Boston issues, totaling $10,000,000 and $25,000,000 respectively, were announced late on July 13 and were absorbed early the following day.

The prompt distribution of the offerings to individual investors led to the floating of a $30,000,000 offering of Consolidated Gas of New York 5s, 1957, authorized some time ago, but withheld pending improved market conditions. The bonds were priced at 94 and interest to yield about 5.44 per cent. Proceeds will be used to discharge obligations for sums borrowed on short-term notes and open account and expended for additions and extensions to the properties of its system. Proceeds from the sale of the Edison Electric issue, which was in the form of notes priced at 99.62 and accrued interest, yielding 5.20 per cent, will also be applied toward the payment of maturing notes.

Not since the week ended June 26, 1931, when new public utility financing reached $142,766,000, has last week's total of new utility offerings been exceeded. The nearest approach to it was in the week ended July 24, 1931, when utility issues aggregating $65,500,000 were marketed. The opinion prevails generally that this test of the bond market has demonstrated that well-managed public utility companies are maintaining their investment standing near the top of the market as they did in prosperous years.

Limited reaction occurred in financial circles to the announcement of state regulatory commissions in Wisconsin and Alabama that common-stock dividend payments by operating utilities to holding companies cease for the time being. Other state commissions do not have this authority and major holding groups are in a strong financial position with one or two exceptions.

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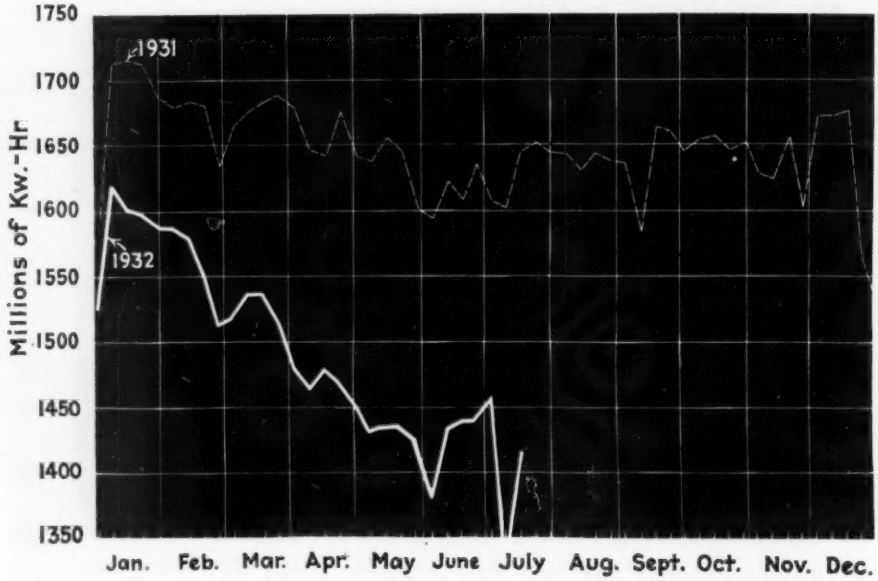
Output Rises, but Less Than in June



OUTPUT of central stations rose to 1,415,704,000 kw.-hr. during the week ended July 16, from 1,341,730,000 kw-hr. in the preceding week, which included Independence Day. The rise did not, however, carry the total up to the level prevailing in June, and in comparison with the corresponding week of 1931 it is down 13.9 per cent. The difference is slightly larger than in other recent weeks, but this is due at least partly to a considerable rise last year.

As indicated in the accompanying tables, based on weekly reports by the National Electric Light Association, the somewhat larger departure from last year's operations, contrasted with the average for the preceding two weeks, was general, but it was most pronounced in the central industrial area and on the Pacific Coast.

In both of these areas the output fell 16 per cent short of last year's.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
July 16	1,416	1,645	1,667	1,727
July 9	1,342	1,604	1,626	1,712
July 2	1,457	1,607	1,594	1,592
June 25	1,441	1,635	1,704	1,723
June 18	1,442	1,610	1,698	1,703

Per Cent Change from 1931

Region	Week Ended July 16	2 Weeks July 9	2 Weeks July 2
Atlantic Seaboard	—10.3	—9.4	.....
New England alone	—11.4	—10.2	.....
Central industrial	—16.1	—14.8	.....
Pacific Coast	—16.2	—13.9	.....
United States	—13.9	—12.8	.....

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Cables to Carry Power from Brooklyn to New York

Under the East River some new cables will soon be carrying power from the Hudson Avenue (Brooklyn) generating stations of the New York Edison System to Manhattan. The cables will be unique in that they will be the first three-conductor oil-filled cables in submarine use in this country. Seven 2,300-ft. lengths have been built, four by the General Electric Company and three by the General Cable Corporation, for the river crossing. The cables, which will carry three-phase, 60-cycle current at 27,000 volts, will have oil pressure reservoirs at each end.

Coast Company Exceeds Heater Sales Quota

For the sixth consecutive year the Pacific Gas & Electric Company exceeded quota in its annual spring range and water heater campaign. Closing on June 30, the campaign resulted in the sale of 2,582 units, or 103.3 per cent of quota for 90 days of sales activity.

Range sales totaled 1,622, against a quota of 1,700, and water heater sales reached 960, against a quota of 800. Of 39 salesmen employed during the campaign 31 exceeded individual quotas set for them, while eight of the twelve divisions of the company exceeded 100 per cent. Approximately 50 per cent of the ranges were sold by dealers and 30 per cent of the water heaters went through retail dealer channels. Sales were greatest in rural territories.

The company sold seven different makes of ranges during the campaign. The only special inducement was an allowance on wiring where the electric range replaced an oil, wood or coal stove.

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Bethlehem Steel Buys Electricity, Sells Coke-Oven Gas

With the execution of a contract to purchase the major portion of its electric requirement from the Consolidated Gas, Electric Light & Power Company, the Bethlehem Steel Company has multiplied its present use of central-station service fifteen times and inaugurated a policy which will result in an eventual demand amounting to 50,000 kw. Under this contract, which went into effect on May 16, 1932, the present power consumption of the Sparrows Point plant is approximately 7,000,000 kw.-hr. monthly. Upon completion of the development program of the Bethlehem Steel Company, the use of purchased power under normal operating conditions will amount to 20,000,000 kw.-hr. monthly, as reported in the Baltimore *Gas and Electric News*.

For many years Consolidated has purchased all of the by-product coke-oven gas produced by the Bethlehem Steel Company except such portions as the steel company requires for heating processes in its own mills. The Bethlehem Steel Company will continue to utilize its by-product blast furnace gas in its own generating plant, but all other power requirements will be supplied from the lines of Consolidated company.

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G. E. in Two Quarters Books $68,000,000

Sales billed by the General Electric Company for the first six months of 1932 amounted to $80,210,498, compared with $141,180,091 for the corresponding period last year, a decrease of 43 per cent. Profit available for dividends on the common stock for the first six months of this year was $7,653,187, compared with $21,523,722 for the first six months of last year. This profit is equivalent to 27 cents per share for six months of 1932 and 75 cents per share for the first six months of 1931, on 28,845,927 shares outstanding in both periods. The profit available for common stock for the second quarter was 11 cents per share, and, therefore, the dividend of 10 cents per share to be paid on July 25 was more than earned. Orders received by the company for the first six months of 1932 amounted to $68,708,712, compared with $141,428,978 for the first half of 1931, a decrease of 51 per cent.

Total current assets were $219,000,000 at the close of 1931, compared with $172,000,000 at the end of 1921. Total current liabilities were $28,000,000 and $24,000,000 respectively. Current assets were 7.7 times current liabilities at the close of 1931 and 7.3 times at the end of 1921.

On June 30, 1932, cash on hand and marketable securities amounted to $111,678,000. During the ten-year period bonds and mortgages have decreased from $38,000,000 to $2,000,000, the latter being 3½ per cent debenture bonds due in 1942, callable at 105.

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Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	June 1931	June 1932	Per Cent Inc. or Dec.	Six Months 1931	Six Months 1932	Per Cent Inc. or Dec.
New York	259	272	+ 5.0	1,619	1,449	—10.5
Middle and Southern Atlantic	100	90	—10.0	766	654	—14.6
New England	102	103	+0.98	562	677	+20.4
Central	487	417	—14.4	3,665	2,991	—18.3
Total	948	882	— 7.0	6,612	5,771	—12.7

Total Amounts Reported

New York	$39,215	$20,926	—46.6	$210,003	$138,123	—34.2
Middle and Southern Atlantic	19,043	9,951	—47.7	102,420	63,291	—38.2
New England	7,448	6,506	—12.6	50,788	49,833	— 1.8
Central	45,477	26,751	—41.2	335,588	226,201	—32.6
Total	$111,183	$64,134	—42.3	$698,809	$477,448	—31.7

Major New Construction This Week

MACHINE drives, motors, controls, panelboards, conveyors and other electrical equipment will be installed in new two and four-story additions to be constructed by International Business Machines Corporation, Endicott, N. Y. Cost $400,000.

Franklin P. Woods, Denver, Colo., engineer, is engaged to prepare plans and equipment bids will soon be asked. for a city-owned hydro-electric power plant to be constructed by Bayward, Neb. Site acquired near Hoth Canyon. Estimated cost $200,000.

Heavy-duty motors, controls, electric-operated pumping machinery and other electrical equipment will be installed in $250,000 addition to be built at oil and gasoline refinery of Utah Oil Refining Company, Salt Lake City, Utah, subsidiary of Midwest Refining Company, Chicago, Ill.

Motors, controls, switching equipment, conveyors and other electrical equipment will be installed for new coal-handling, storage and distributing plant to be constructed at Bolton Station, Baltimore, Md., by Pennsylvania Railroad Company, at cost of $150,000. Similar electrical equipment with electric-operated traveling cranes will be installed at container car yards of railroad at Enola, near Harrisburg, Pa., for handling steel container units, estimated to cost $100,000.

Oakland, Calif., has authorized plans and makes early call for equipment bids for ornamental street-lighting system to cost over $50,000.

Machine drives, heavy-duty motors and controls, transformers and accessory apparatus, heavy-duty electric cranes and other electrical equipment will be installed in steel fabricating plant to be built by Babcock & Wilcox Company, New York, on federal reservation near Boulder City, Nev., for production of large steel pipe sections for Hoover Dam project.

Belgian Katanga Will Restrict Copper Production

The agreement between world copper interests made early in the year in New York, to curtail production to approximately 20 per cent of capacity will be observed by the Belgian government copper group, Katanga.

British copper executives on their way to the Imperial Economic Conference at Ottawa are talking of a 1 cent or less tariff to protect Rhodesian and Canadian output.

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New York Metal Prices

	July 13, 1932 Cents per Pound	July 19, 1932 Cents per Pound
Copper, electrolytic	5.25	5.25
Lead, Am. S. & R. price	2.70	2.65
Antimony	5.00	5.00
Nickel, ingot	35.00	35.00
Zinc, spots	2.90	2.85
Tin, Straits	21.00	20.875
Aluminum, 99 per cent.	23.30	23.30

Federal Loan Sought for Hydro

J. D. Ross, superintendent of Seattle's city light department, has been sent to Washington, D. C., by Mayor John F. Dore, in an effort to obtain $3,500,000 from the federal government as a loan for the completion of the Skagit hydro-electric project. Mr. Ross will be the official emissary of the city to investigate the availability of federal relief funds for the city light department and the city itself as an aid in overcoming local unemployment.

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Optimistic on Electrical Outlook

Presiding at the annual meeting of the General Electric Company just held in London, Chairman Sir Hugo Hirst spoke fairly hopefully of the outlook for the electrical manufacturing industry. He said that those engaged in the industry in Britain were particularly justified in expressing such sentiments, as they were spending a great deal in research and development, and consequently if some of the older departments showed a decline they were encouraged by new possibilities.

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Chemists Discuss Equipment Design

About fifteen papers on the design, construction and operation of large-scale equipment in which a chemical reaction takes place will be presented before the division of industrial and engineering chemistry of the American Chemical Society at the society's 84th meeting at Denver, Colo., August 22-26. There will also be symposiums on the physical chemistry of metals and in the fields of colloids, paints and varnishes.

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Air-Conditioning Bureau in Boston

The Edison Electric Illuminating Company of Boston is now giving the benefit of another consulting engineering service to its customers in connection with air conditioning by means of water, electricity and steam. The work is proceeding under the direction of Daniel Ricker, head of the newly created air-conditioning division of the promotion department. Its present service is strictly of an advisory nature and is not based on any direct sales effort to merchandise a product.

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Institute Seeks Museum Exhibits

Information concerning materials of historic, scientific or industrial interest is being sought by the Franklin Institute for its new museum on the Parkway in Philadelphia. Dr. Howard McClenahan, secretary and director of the institute, asks for information about machines or working models pertaining to accoustics, electricity, life-saving apparatus, motive power, physics, railway engineering and weights and measures.

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District Steam Increased Fivefold

Starting with a connected load of 315,985 sq.ft. of equivalent direct radiation taken over in 1928 with the purchase of the Terminal Company, the connected steam load of the Consolidated Gas, Electric Light & Power Company of Baltimore has increased through intensive sales effort to 1,689,000 sq.ft. of equivalent direct radiation, or approximately 5½ times in less than four years. Today approximately 80 per cent of the business adjacent to the existing mains is being served by the company.

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60-Cycle Changeover Ordered

The Public Service Commission has directed the New York State Electric & Gas Corporation to complete the work started about three years ago of changing its 25-cycle service to 60-cycle service for domestic and commercial uses of electricity in the central division of its territory in Otsego County. The customers agreed to pay the cost of changing their appliances.

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Home-Lighting Course at Nela Park

A four-day course in home-lighting practice to be held August 29 to September 1 has been announced by the General Electric Lighting Institute at Nela Park, Cleveland, Ohio. In addition to discussions by Nela Park specialists, the program will offer a talk by Mrs. Mary Davis Gillies, interior decoration editor of *McCall's*, who will speak on the fundamentals of interior decoration.

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Power District for Washington?

A petition containing 2,615 names, twice the number necessary, has been filed in the county auditor's office, asking that Spokane County, outside of the city of Spokane, be formed into a power district under the Grange power law. Following a hearing, it will be possible to place the petition topic on the ballot for the November election if a favorable decision is reached at the hearing.

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Electric Sign Tax Proposed

To get more revenue the Borough of Manhattan, New York City, is proposing to increase the tax on electric signs by making it $1 per square foot instead of the present $1 flat. This change would produce $3,000,000 additional revenue for the city.

Chicago Lighting Institute Flourishes

Up to the end of June 92,993 people had visited the Chicago Lighting Institute in the three years since its opening. In June there were 2,562 visitors, of whom all but 32 were members of the public at large or of groups interested in lighting but unassociated with the electrical industry. Grocers brought 230 members to the Institute to observe proper methods of lighting show windows and store interiors. Armour & Company sponsored the visit of butchers and other groups included printers, building owners and managers, machine tool makers and civic service clubs.

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Nebraska Receivership Asked

Appointment of receivers for the Missouri Valley Public Service Company, with main offices in Omaha, Neb., has been asked in a suit filed in Chancery Court in Wilmington, Del., by M. J. Weh of Chicago, a creditor in the amount of $3,672.

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Youngstown Rates Under Negotiation

The City Council of Youngstown, Ohio, has authorized its utilities committee to begin negotiations with the Ohio Edison Company for a new light and power rate on a sliding scale to replace the present flat rate of 6 cents a kilowatt-hour. Councilmen have been trying to get a rate cut for several months. C. S. MacCalla, general manager of Ohio Edison, stated he was willing to confer with the utilities committee on a new rate, provided a sliding scale supplanted the flat rate.

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Laramie Imposes License Tax

An ordinance levying a license tax of $2,000 a month on companies selling electric current in Laramie, Wyo., has been passed by the City Council. The Western Public Service Company is the only concern furnishing power and light there at present.

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P.G.E. Makes San Joaquin Offer

The Pacific Gas & Electric Company has offered to exchange its securities for those of San Joaquin Light & Power Corporation on the following basis: Four shares of Pacific Gas 6 per cent preferred for each share of San Joaquin 7 per cent preferred, three shares of 6 per cent preferred and one share of common for each share of San Joaquin 7 per cent prior preferred, four shares of Pacific Gas 6 per cent preferred for each share of 7 per cent preferred, series A, four shares of Pacific Gas 5½ per cent preferred for each share of San Joaquin 6 per cent preferred.

Chromium Plating Applied to Steel Mill Rolls

Latest of the contributions of electrically deposited metals to the advancement of industry is the use of chromium-plated steel mill rolls. Roller leveler rolls and cold-finishing rolls are notable uses. In the case of the former it is possible to substitute ordinary forged steel (0.70 to 0.80 per cent carbon) for tool steel and it is said that, having a well-grounded finish on the roll before chromium plating, a much higher finish can be offered than with a tool steel roll.

Because of the extreme hardness of chromium, these plated leveler rolls remain in service over a long period of time, often outlasting a tool steel roll from four to six regrinding periods. When the plated leveler rolls finally indicate some wearing through of the chromium plate, provided the underlying steel has not been marred, the plating can be stripped and again chromium plated without regrinding. The cost of such plating is said to be relatively inexpensive considering the initial cost of the rolls.

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X-ray Attains Snapshot Speed

An X-ray machine that can take snapshots and that will be able to photograph moving internal organs of the body has been developed and is now being tested by the New York Hospital-Cornell Medical Center. It takes pictures about twenty times faster than the ordinary radiograph and will be able, because of the increased amount of light that can be used, to photograph clearly such soft tissues as incipient ulcers, ruptures of the muscles and cancerous growths.

Research workers and technicians of the General Electric Company worked in collaboration with Dr. John R. Carty, radiologist of the New York Hospital and associate professor of radiology at Cornell University Medical College, to perfect it.

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Voltage Divider Devised for Cathode Oscillograph

Unfortunately the voltage that can be measured directly with the cathode-ray oscillograph is limited, hence it is necessary to divide the applied voltage and measure only a known fraction of the total voltage. Research at the Bureau of Standards, Washington, has resulted in the development of a capacitance voltage divider, suitable for a wide variety of uses. This divider is described in research paper No. 460, "Voltage Dividers for Use with Cathode-Ray Oscillograph," published in the July number of the Bureau of Standards *Journal of Research*.

Following a section devoted to a description of apparatus used, including the cathode-ray oscillograph, a number of oscillograms are given to show the results obtained with the divider in various applications. In the course of the investigation a great deal of attention was paid to oscillograph technique and a section of the paper is devoted to this subject. The paper concludes with a discussion of calibration of the voltage divider.

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Six-Ton Chandelier Makes Sun of Radio City Ceiling

Twenty-five feet in diameter and 6 tons in weight are the dimensions of the chandelier to be installed in the ceiling of the photoplay theater in Rockefeller Center in New York City. Elaborate ventilation will be necessary to dispose of the heat of its 104 kw. in the 400 floodlights which will be housed in its bowl.

Cox, Nostrand & Gunnison are at work on this indirect fixture, which will be supplemented by beams of direct light from hidden sources behind some 200 small holes in the ceiling. The combination of chandelier and aperture sources will be capable of blending color schemes in red, green, blue and amber as well as full white.

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Lapel Microphones Made Delegates Audible to World

In its broadcast of the Democratic convention the Columbia Broadcasting Company used the lapel microphone extensively. It made possible a mobile pick-up from the floor and thus brought first-hand to the radio audience aspects of those dramatic proceedings which would otherwise have been relayed by announcers.

Counterweighted microphone leads from the booth at the rear of the hall were dropped from the roof to six spaced points in the convention hall. At these stations page boys were located, each equipped with a lapel microphone connected to these circuits. Each boy was also provided with a chart showing the location of the state delegations on the floor.

When the vote of a certain state was called for the page nearest that delegation went immediately to the section chairman and placed the microphone on his lapel. The chairman then announced the vote of his state in an ordinary tone of voice which was clearly picked up and heard from coast to coast. It was also amplified so that it could be heard distinctly throughout the hall.

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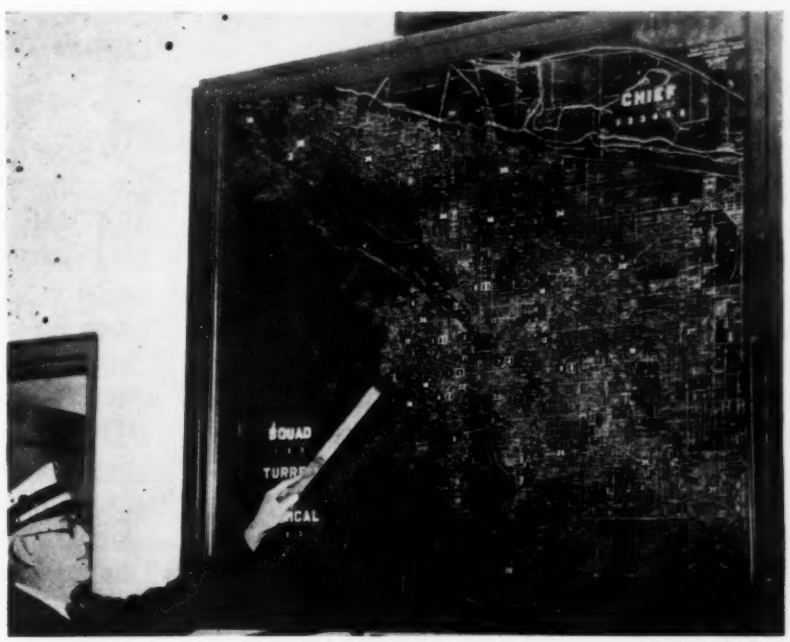
PORTLAND KEEPS TAB ELECTRICALLY ON ITS FIRES



—Wide World Photos

This electrical map, recently installed in the Portland (Ore.) Fire Department headquarters, reveals the exact location of any fire and the nearest fire company. When the alarm is sounded the light behind the locality of the fire burns. When any fire company answers a light appears back of its designated position.

EDITORIALS

L.W.W.MORROW
Editor

Signs of stability are evident

SIGNS of stability are more evident now than in the past three years. Commodity price levels have remained stationary for several weeks and have turned upward. The bond and stock markets have strengthened and several utility refunding issues have been accepted readily by investors. Farmers are encouraged by the increased price levels of hogs and cattle and reports from all sections show gains in public confidence. The conclusion is inevitable that the major forces of deflation have spent themselves.

Conditions in the electrical industry are more stable also. Energy production figures are encouraging, refunding issues are planned with prospects favorable for investor acceptance and sales by manufacturers have been held level for some months. Political conditions are also good despite the obvious attempt of the Federal Power Commission to stage a political advertising stunt last week and agitations for rate reductions based upon changes in dollar values in certain sections. Favorable legislation by Congress, followed by its adjournment, may give the added psychological impetus needed to point the way to normal business, especially if industry leaders go forward with courage and confidence.

A new meaning to emergency service

TANTALIZING as it may be to admit it, there are still many industrial plants making their own power. Undoubtedly a sizable percentage of those operations have justified their independent generation when times were normal because of process requirments, steam for heat and for secondary activities, and so forth. But in times of greatly curtailed industrial activities there must be a large number of these plants that reflect high cost of energy because of the low loading of relatively large units.

These situations beckon to the power sales bureaus of the commercial departments of the utilities. What if the proprietors did turn a deaf ear to convincing economies in the past? The pressure is on them today to pare operating expenses to a degree that opens their minds to a fresh presentation of dollar-saving arguments. Power sales engineers should pocket their pride and sally forth on a new crusade with a new slogan. The slogan is emergency service—not the emergency of physical breakdown but the emergency created by the breakdown of economic balances. Also a shrewd eye toward the future will suggest that an entry in these days may well pave the way for a more embracive contract when production goes back to its wonted levels.

When are prices too high?

THE criticism which is being directed by some newspapers at the railroad executives' salaries, just made public by the Interstate Commerce Commission, raises a question which applies to all price or expense comparisons, yet never seems to be considered in most criticisms. This question is, "with what price or cost or expense is the criticised figure being compared?" It can't be justifiedly claimed that a price is too high just because it is large. Without a basis of comparison there is no ground for conclusions.

On salaries, for example, the amount must be compared with the cost of obtaining the *same* quality of service under the *same* operating conditions with some other method or personnel. And it must not be forgotten that prices paid for serv-

ices are usually determined by what other organizations will pay for those services. In the particular case mentioned, or even in the case of electric light and power utilities, it is not beyond reason to believe that if the executives whose salaries are criticised could not secure them in their present positions they would change to positions which would pay that amount or more, and the industries now having their services would either have to get along with reduced-caliber service or, as frequently happens, would have to divide the responsibilities among several men with a larger aggregate salary. Of course, this comment applies to normal conditions when men can change positions fairly freely.

What has been said on salaries applies in modified form to charges for management or financial service, cost of engineering, cost of rural lines, cost of operation, rates—cost of anything.

There must be a reasonable basis for comparison before any one can say that any price, salary or cost is too high. Without it any conclusions reached are fallacious.

An "alibi" for the existence of less domestic business

REMARKABLE stability in domestic business has characterized the depression, but some recent indications point to a slowing down in the rate of growth in this class of service. For some time the monthly increase in domestic use has been small. Several explanations have been given.

Public purchasing power has been shrinking continuously, it is true, but this explanation does not tell the whole story. The most positive influence has been the lessened aggressiveness in merchandising. In some localities anti-merchandising legislation is showing bad results; in other localties utilities have concentrated on sales of load-building appliances only; in still other instances aggressive utility merchandising has been halted either to bring about better relations with dealers or to reduce the losses of the merchandising departments at the demand of executives. Undoubtedly also the concentration of sales attention on refrigeration and ranges caused a drop in the pressure of dealers upon the sale of other appliances.

We do not believe that the "alibi" of decreased public purchasing power is the right one. The real reason for a slowing down in business must lie in poor selling. A more aggressive and balanced approach to the market is needed now, and there should be less tendency to quit selling on the plea that the public is unable to buy.

An employment plan with business possibilities

THE emergency employment committee of the Institute of Radio Engineers has recently proposed a plan to put idle electronic engineers to work which might be carried a step further to stimulate a new business, the possibilities of which, one steel man declared recently, are hardly conceived by its originators. In other words, besides being an altruistic move it can be made an economic business activity.

In general, the Radio Engineers' plan is for idle electronic engineers to study production processes in their neighboring industries and commercial establishments and show them how they can save operating expense, maintain high-quality production with lower expenditures, etc., by applying electron-tube control to different processes which are now ineffectively handled manually or mechanically. They can even go so far as to apply their suggestions to some process to prove its practicability and economy.

If this plan is extensively followed it will speed the day when electronic-tube control will be more widely applied and a large industry will be developed, which in turn will bring a return to investors and workers engaged in the engineering, production, application, selling and servicing of these applications.

But why stop with concerted individual attack on this attractive field of endeavor? If the new possibilities of applications of electron-tube control are cleared through some central organization and then redistributed to manufacturers, engineering consultants and disseminators of new ideas they can be spread before industry nationally and internationally without waiting for industries ten years hence to realize that they overlooked some economies on which they could have capitalized for ten years. The opportunity for new business is here. Why wait for it to develop voluntarily?

Long Lift Bridge Raised by New Drive

By J. A. SETTER
Industrial Engineering Department,
General Electric Company, Schenectady, N. Y.

WITH the recent opening to traffic of the world's longest railroad lift bridge there was recorded another great step in the advancement of the movable bridge art. The bridge crosses the Missouri River at Boonville, Mo., on the line of the Missouri-Kansas-Texas Railroad. Its 408-ft. span is lifted by electric drive which provides through unique synchronizing devices desirable operating characteristics not heretofore available for bridges.

The merits of the new design embrace the following points of interest to the structural engineer. The feature of operating the entire bridge with only one lifting motor is in itself an important factor in preventing delay to railroad and navigation traffic due to the failure of a lifting motor on either tower. Of interest also is that the cost of the electrical installation is very little greater, if any, than previous systems because the conventional spare motor required on all bridges is utilized during normal operation as a synchronizing motor. Furthermore, the saving in cost due to the reduction in weight of the lift span by removing operating machinery to the towers and the elimination of the long-haulage cables and sheaves should promote the use of the synchronizing motor tower drive system on lift bridges in the future.

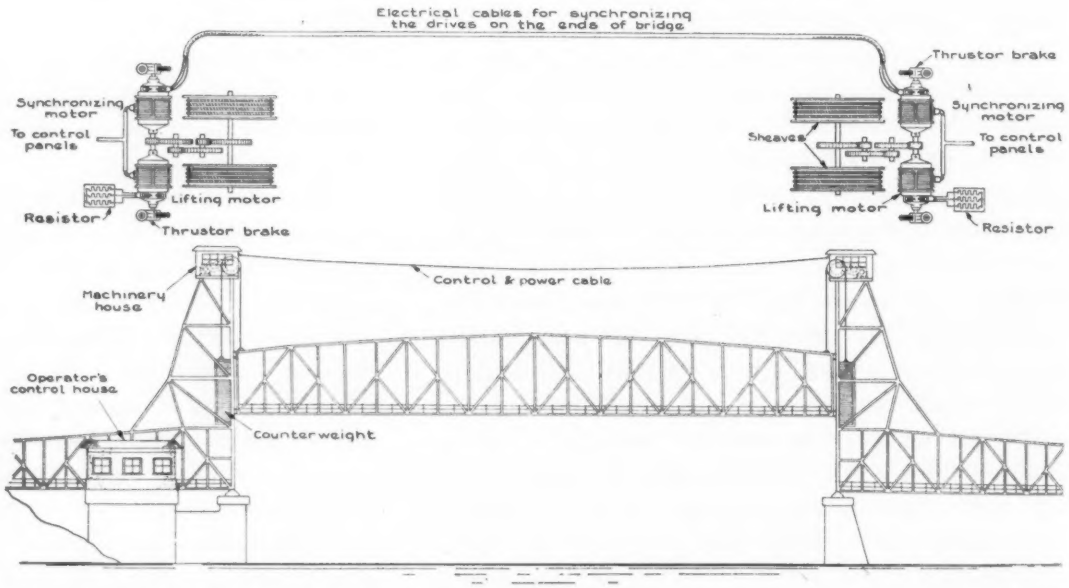
On the majority of lift bridges built in the past the entire power plant is located in a machinery house at the center of the span and is raised and lowered with the bridge. On this new bridge the operating machinery to lift the ends separately is located in houses at the top of each lift tower. The entire structural steel system of the lift span can thus be substantially decreased in weight.

A tower drive of this nature presents problems because both ends of the span must be raised simultaneously to keep the span absolutely level and to prevent jamming it between the towers. On some previous bridges with tower drive manual leveling has been utilized to keep the lifting motors running at the same speed, but this is subject to the human element and is likely to produce damage to the bridge unless carefully watched. To this end, therefore, a reliable electrical synchronizing system is employed on this bridge to keep it absolutely level at all times during normal operation, without undue care on the part of the operator.

Induction motors have rotors opposed

The principle of operation of the synchronizing drive is that two wound-rotor induction motors whose rotors are connected together in phase opposition will operate in synchronism if their stators are connected to a common source of power and they are driven by some form of motive power. If when the lifting motors on both towers are accelerating or are unequally loaded and one

Two ends of 408-ft. span are held within ¼ in. of level by synchronizing equipment



The electrical equipment operates on 440-volt, three-phase, 60-cycle power supplied from a primary 2,300-volt source. The lifting motors and control switchboard panels, as previously mentioned, are located on the towers and are remotely operated from a control desk and switchboard located in the operator's house at one end of the fixed structure. The motive power in each tower consists of an 80-hp., 600-r.p.m. crane-type wound-rotor induction motor geared to two driving sheaves, over which pass 32 steel cables supporting the span and counterweight. A duplicate motor for synchronizing purposes is coupled to the shaft and is driven against its normal phase rotation by the lifting motor. The two tower operating mechanisms are then electrically tied together by a three-phase cable connecting the slip rings of the two synchronizing motors as shown in the accompanying sketch. Normal speed of lift of the bridge is about 35 ft. per minute. The total lift is approximately 30 ft.

tends to slow down in speed, there is an immediate phase shift in the rotors of the synchronizing motors and a rotor current immediately flows from the one tending to run at the higher average speed to produce torque in the other at the lower average speed. The effect is then to prevent any change in average speed of the driving motors, which, therefore, means the bridge is raised and lowered level at all times unless the breakdown torque is exceeded, in which case overload relays prevent damage.

Actual operation of the Boonville bridge has proved the value of the synchronizing motor leveling scheme because the bridge has not become as much as $\frac{1}{4}$ in. out of level in 408 ft. even during the accelerating period, which is the most severe test.

The size of the synchronizing motors depends upon the torque unbalance contemplated, and on this bridge for emergency operation they are duplicates of the lifting motors. The pull-out torque of these synchronizing motors is about 200 per cent of full load on the lifting motors with a phase shift of about 85 deg. and it has been found that a phase shift of about 20 electrical degrees allows a torque transfer of 100 per cent from one side to the other. The synchronizing motors of themselves do not supply any driving torque. If 100 per cent torque is being transmitted one driving motor is carrying its own load plus the transfer torque. The Boonville bridge can be successfully operated with a lifting motor in one tower disconnected, inasmuch as the lifting motor in the other tower raises both ends equally through the synchronizing motors.

Single phase applied at start

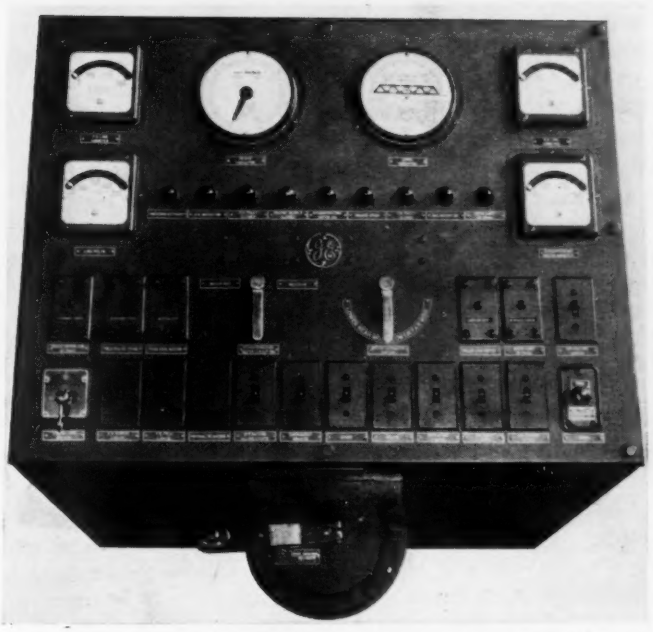
When the two motors are being synchronized each time the bridge is opened single phase is applied to the stators of the synchronizing motors to pull them in step before power is subsequently applied to the driving motors. By synchronizing single phase, the rotating tendency is missing due to absence of a rotating field, and with the rotors once together the third phase can be closed during the further operation of the equipment and the motors run in synchronism.

Control equipment on a bridge of this kind is an important and interesting part of the equipment. Full magnetic remote control is used, with individual panels on the near and far side towers operated from a remote-control desk and switchboard located in the operator's house.

Each driving motor has its own reversing and accelerating contactors, which are simultaneously controlled by a single master switch. Assurance is thus provided that both driving motors are thrown on the line together and also have their secondary resistance cut out equally. This allows them to run at nearly the same speed without undue torque transfer by the synchronizing motors.

In addition each synchronizing motor has a pair of two-pole reversing contactors for applying the single-phase excitation and another single-pole contactor for closing the third phase after the drive is locked together. The reversing contactors supply excitation of the correct phase rotation, which is in opposition to that of the driving motors when the bridge is raising or lowering.

When the master switch is thrown to the first point (either raise or lower) the service brakes are released. This removes any restraining forces on the motor-driven shafts. At the same time the single-phase contactors apply power to the two synchronizing motors and the motors rotate sufficiently to lock the two driving mechanisms together.



Selsyn level indicator shows functioning of unique synchronization of lift motors

On the second point of the controller low torque power is applied to both driving motors with all resistance in the secondary circuit. After a definite time delay, to assure that the drive has synchronized, a relay closes the third phase to the synchronizing motors and the two ends of the bridge operate in unison throughout the further operation.

Succeeding points of the controller bring the motors up to full speed by removing secondary resistance. Definite time relays retard the acceleration regardless of how fast the master switch is operated.

When the bridge is fully opened geared type limit switches remove power from the driving motors and the brakes set. However, power remains on the synchronizing motors for a few seconds to assure synchronism while the bridge is coming to rest.

The operation in the lowering direction is similar, except that at the nearly closed position the bridge stops and it is necessary to return the master switch to the off position and advance it slowly to seat the bridge at limited low speed to prevent bumping. An automatic relay functions at this point to allow this seating operation without the conventional foot-switch operation, which is usually abused.

Just before the bridge fully seats the synchronizing motors are disconnected by a limit switch to allow each end of the bridge to come to its final resting position on the fixed supports. Due to cable stretch, backlash or other causes a locked condition of the synchronizing motors might allow one end to seat with the other off a fraction of an inch, which is undesirable. Separate plunger-type, snap-action limit switches at each end of the bridge set the emergency brakes before removing power from the driving motors, thus preventing a rebound when the bridge seats. For the next raising operation the synchronizing motors are again locked together on the first point of the controller.

To provide for flexibility in emergencies, such as a burnout of a driving motor on either side of the bridge, suitable double-throw knife switches are provided, such that the synchronizing motor on that side can be immediately connected as a driving motor. In this way the conventional spare motor generally required on all lift-bridge installations is available.

Under this emergency condition, therefore, it is necessary to provide other leveling means to prevent the bridge becoming out of skew due to carelessness of an operator. Small Selsyn generators geared directly to the driving sheaves are connected to a differential Selsyn follow-up

generator which closes mercury contacts if either end of the bridge is higher than the other. A system of relays then inserts secondary resistance in the driving motor running at the higher speed to slow it down. This system is intended to insert resistance when the bridge is out of level approximately 2 in. or more, as otherwise a hunting condition might exist of continually inserting resistance in one side or the other.

If due to the insertion of resistance the motor does not slow down and the bridge becomes approximately 6 in. out of level an additional ultimate skew limit contact on the Selsyn removes power and sets the brakes. It is then necessary for an authorized person to level the bridge manually before operation can be resumed.

As mentioned previously, the entire bridge can be operated with one lifting motor in an emergency, although this imposes a double load on the motor and is not recommended for long periods.

Selsyn indicators are provided on the control desk consisting of miniature bridge pointers to indicate whether or not the bridge is level, and also to show the height of the bridge at all times. These indicators can be seen on the top of the desk in an accompanying illustration.

Control switches and buttons are provided for operating all lights and auxiliary equipment that the operator has at his command. Meters are installed for reading various currents and voltages and any undesirable operating condition can be immediately detected.

Electric Heat Can Avoid This Loss

A large monetary loss can be avoided by use of electric heat in steel mills or forging operations, judging from the paper presented before the Association of Iron and Steel Mill Electrical Engineers recently by D. W. Murphy, although he makes no mention of the possibility. His paper is confined entirely to the influence of atmosphere and temperature on scale losses.

In 1929, he estimates, the losses due to scaling (oxidation) during the soaking period prior to rolling might easily have reached $830,000 to $1,310,000. Even in 1931 these losses probably attained $326,000 to $520,000. In the forging industry alone the losses ranged from $220,000 to $352,000 in 1929 and from $70,000 to $112,000 in 1931.

Other detrimental reactions from excessive scaling include: (1) Shorter life of furnace refractories; (2) occupies space in forging dies and may result in wrong dimensions; (3) if rolled into metal may cause imperfections and failure; (4) requires additional labor and equipment cost to remove.

Scaling is dependent on the furnace atmosphere, temperature, gas pressure, surface exposed, duration of exposure and is particularly severe above 2,480 deg. F. The presence of as little as 0.1 per cent sulphur dioxide in the gases seriously increases scaling; oxygen is also detrimental. More than 8 per cent CO reduces scaling.

Some Facts Every One Should Know About Trade Acceptances*

Means of bridging the gap between the abundant credit supplies of American banks and needs of commerce, industry and agriculture.

Came into use chiefly after the Civil War.

Really a post-dated draft on the buyer which has been accepted and signed by both him and the seller, giving it the standing of two-name paper. (In some ways it is a post-dated check having two indorsements.) If indorsed by buyer's banker it has even higher standing. Greater security than a buyer's note because it is two-name paper and more negotiable.

A negotiable instrument of credit which is eagerly sought by Federal Reserve and other banks for investment of cash. First-quality trade acceptances are more attractive to banks than municipal bonds and other bonds once considered first-class risks. Considerable cash is waiting investment and first-quality trade acceptances provide the outlet.

Puts money in circulation, which is very important in stimulating business. There are usually more than $4,000,000,000 in open accounts. If just one-third of these were trade acceptances, more than $1,000,000,000 would be put in circulation, benefiting every person through whose hands they pass.

Bankers very favorable toward use of trade acceptances by their clients for engaging in activities that will increase business, even for advertising, sales work and modernization, if acceptor will liquidate face of acceptance within 90 days. Some acceptances for maturity in six months are discounted by banks, but at higher rates.

Should be confined to current transactions that will be self-liquidating in 90 days or less.

Puts cash now in banks back of every deserving enterprise that liquidates face of trade acceptance in 60-90 days.

Many companies now insist that short-term time payments be made on trade acceptance basis instead of open account to protect accounts receivable, reduce cost of collections and increase credit of seller with banks.

98 per cent of trade acceptances are paid on maturity, whereas only 75 per cent of open accounts are so paid. One reason is that failure to pay open accounts promptly is usually known only to the seller and buyer, whereas failure to pay trade acceptance on maturity is likely to be known to every one through whose hands it circulates, thereby inducing the acceptor to preserve his credit standing by paying promptly.

Should never be used for overdue accounts.

Not applicable to small accounts or those of ultimate consumer (with exceptions) as the cost of handling small accounts is as great as large accounts and would require an enormous clearing house organization.

Discounts range from 2-3 per cent, depending on quality of trade acceptance, but this is offset by reduced cost of collecting accounts.

Trade acceptances should never be held, but sold in open market to keep money in circulation, otherwise one major value is sacrified.

**For more thorough discussion consult American Acceptance Council, 120 Broadway, New York.*

Street Lighting Increased 400 per Cent

By GILBERT ROBINSON
Electrical Engineering Department, Boston Edison Company

Coincidentally with the improvement of several major highways serving the Charles River Embankment district at the foot of Beacon Hill in Boston the city embraced the opportunity to increase the street lighting by approximately 400 per cent despite the pressure of the times against large-scale betterments. The intersection of Cambridge and Charles Streets is one of the busiest traffic centers in Boston and the improvements now approaching completion include the widening of Charles Street for about 0.75 mile north of the Longfellow Bridge, the building of a rapid transit elevated railway station and construction of a traffic circle at the intersection of the above principal streets. The part played by modernized street lighting in this work and its contribution to the safer handling of fast-moving and dense traffic justified the additional outlay.

The lighting on Charles Street was formerly supplied from 6.6-amp. direct-current series circuits from the "L" Street generating station in South Boston, which were practically fully loaded at the time of this development. The new 1,500-cp. units around the inner traffic circles were spaced from 60 to 90 ft. and around the outer traffic circles 75 to 100 ft. Between the traffic circles lights were spaced 100 ft. opposite each other, with additional lights at each street crossover. A traffic cut-off opposite Cambridge Street was provided with 1,000-cp. units and 600-cp. units were installed at the new elevated station. The proposed increase in load was considered an opportune time to install two 20-amp. alternating-current series circuits from the adjacent Cambridge Street substation.

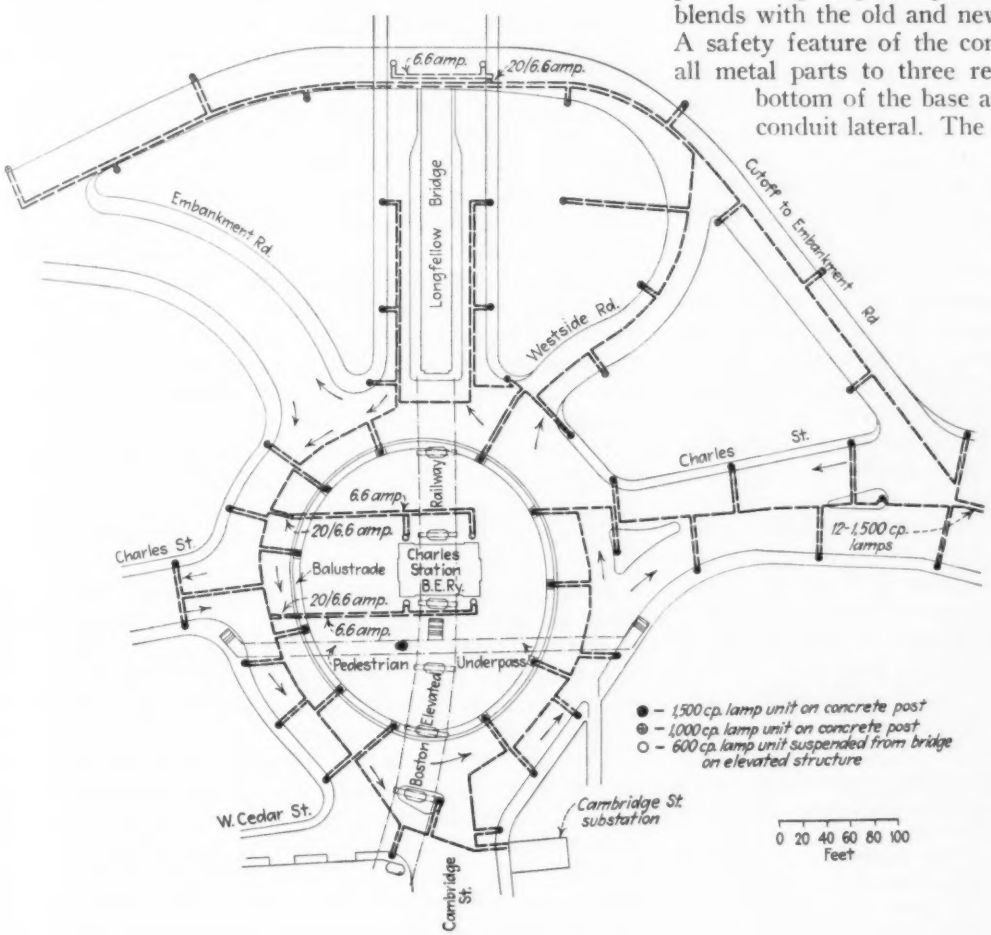
Advantages of 20-amp. system

1. Size No. 6 B&S gage conductor is loaded to a more economical point.
2. The circuit voltage for the given load could be reduced to approximately one-third that of a 6.6-amp. series circuit, thus effecting a lower and safer operating voltage.
3. Cable insulation could then be reduced from 10 kv. to 5 kv. with a consequent saving in cost.
4. Individual insulating or auto-transformers could be eliminated for the 1,000 and 1,500-cp. lamps.
5. The looping of the series circuit directly to the lamp sockets of the 1,000 and 1,500-cp. lamps greatly simplifies the installation and maintenance.

The installation includes 97 hollow concrete 15-ft. posts, one 12-ft. post, each with a "novalux" unit equipped with a 1,500-cp. incandescent lamp; eleven hollow concrete 15-ft. posts, each with a 1,000-cp. lamp and six pendent type "Novalux" units, each with a 600-cp. lamp supported from the bridge or elevated structures. Eleven of the 15-ft. posts with 1,500 lamps were set into a previously prepared balustrade around the inner edge of the Cambridge Street traffic circle. The assembled post and lighting unit present a pleasing appearance that blends with the old and new architecture of the district. A safety feature of the concrete post is the bonding of all metal parts to three reinforcing rods which at the bottom of the base are grounded to the lamp-post conduit lateral. The cable sheaths are also bonded in each manhole.

The station equipment consists of a 60-kw., 13,800-volt primary with a 20-amp. secondary, constant-current transformer for each circuit.

The continuous flow of vehicles along this heavy traffic thoroughfare could not be interrupted during the road construction period as there was no suitable traffic cut-off. Therefore, it was found necessary to keep the roadway lighted, which was accomplished by shifting the old lamp-posts to meet the progress of the field construction.



Location and sizes of lamps permit high-speed traffic flow through intersection points with safety to vehicles and pedestrians

Steam Power Station Practices

By ALEX D. BAILEY, A. G. CHRISTIE and F. A. ALLNER*

Survey of present practices.

Data on operating performance and design.

Trends and recommendations for future developments.

STEAM pressures in recent American central stations are in the range of 450, 600 or 1,200 lb. per square inch. Temperatures vary from 700 to 825 deg. F., with one plant at 850 deg. F. Plants with 1,200 lb. pressure have operated satisfactorily and the expected economies have been realized. One builder offers turbines for 1,200 lb. per square inch, 1,000 deg. F. with no reheat. The trend is toward higher pressures and temperatures.

All recent turbines are bled at one to five points for regenerative feed heating. Turbines for 600 and 1,200 lb. usually have one stage of reheating. Flue gas reheaters give the highest station economy, but steam reheaters suffice where it is only desired to decrease moisture at exhaust. These two types are combined in several plants to secure constant reheat temperatures.

Coal Supply—Recent installations of coal silos outside the boiler room and of coal storage in out-door piles indicate a trend toward the total elimination of the inside coal bunker. These changes reduce station cost and improve boiler-room lighting. Coal is handled by rotary car dumpers, drag scrapers, locomotive cranes, belt conveyors, or skip hoists. Recent plants have complete coal-weighing and sampling equipment.

Steam-Generating Units—Cross-drum horizontal, two-drum vertical, Stirling and other types of water-tube boilers are in service. The use of single-pass boilers is increasing, since these cost less, permit simpler boiler plant, carry higher ratings and have lower draft losses than multi-pass units. A few boilers with welded drums are in service. The trend is toward the use of units of great capacity, both in square feet of heating surface and in steam output. A boiler at the East River station, New York, contains 60,706 sq.ft. of water-heating surface and has produced 1,250,000 lb. of steam per hour. Maximum tube length is 36 ft. Certain new boilers have a small amount of water-heating surface, often single pass, followed by large superheating, steaming economizer and air-heater surfaces. Centralized boiler control is becoming standard practice.

"Unit" system plants with one boiler per turbine, each with its essential auxiliaries, as, for example, Gould Street station, Baltimore, are now in service. A recent study† shows that the availability factor of large output boilers is about 85 per cent, while the average availability factor for turbines is about 90 per cent. The availability factor for boilers appears to increase and the cost of maintenance per million pounds of water evaporated to decrease with increased boiler output. High-pressure plants have proved reliable. In 1931 the 1,300-lb. section of Lakeside station, Milwaukee, had availability factors of more than 90 per cent for both boilers and turbines. The high efficiency of large steam generators is maintained over a wide range of load. Large output boilers appear to be the most economical units to install in a new plant.

Both convection and radiant superheaters and reheaters are in use. Combinations of convection and radiant surfaces give almost constant steam temperatures at all boiler loads.

Boiler water conditioning, especially at high pressures, is receiving much attention. The maintenance of proper sulphate-alkalinity ratios has overcome caustic embrittlement. Foaming and priming at high ratings, when boiler water concentration is high, cause impurities to be carried over to the turbine. These close blade passages and decrease output. Such scale deposits, provided they are soluble in water, may be removed by washing with wet steam while the turbine is in service. The problem of washing is growing in importance and may ultimately become a major consideration in plant operation.

Steaming economizers are used with high-temperature feedwater. Air heaters serve with or without economizers to provide air temperatures in the neighborhood of 350 deg. F. for stokers and 400 to 650 deg. F. for pulverized coal.

Water-cooled furnace walls with exposed tubes, fin tubes or tubes faced with bare or refractory-coated cast-iron blocks are installed under nearly all large output boilers with either stokers or pulverized coal. Such side walls in stoker plants prevent the adherence of fused ash to the setting.

The high heat absorption rates prevailing in large output boilers and in water walls have developed problems of water circulation and of water levels in drums. These difficulties are being studied and should be corrected in new designs. Frequently drums of horizontal water-tube boilers are placed at a high elevation to provide a greater static heat on the water in the tubes.

*Abstract of paper submitted by the American Committee to the International Electrical Congress, Paris, July 4-12, 1932.

†"Performance of Modern Steam Generating Units," C. F. Hirshfeld and G. A. Moran, A.S.M.E., 1931.

Table I—Estimate of the Unit Investment in Public Utility Power Plants

Dec. 31 of Year	—Water Power Plants— Installed Capacity, Kw.	Total Cumulative Investment	Average per Kw.	—Fuel-Using Plants— Installed Capacity, Kw.	Total Cumulative Investment	Average per Kw.
1920	3,850,000	$962,500,000	$250	9,150,000	$1,148,500,000	$125
1921	4,025,000	1,015,000,000	252	9,635,000	1,199,000,000	124
1922	4,150,000	1,079,000,000	260	10,750,000	1,300,000,000	121
1923	4,600,000	1,153,000,000	250	11,900,000	1,509,000,000	127
1924	5,150,000	1,263,000,000	245	13,600,000	1,779,000,000	131
1925	5,850,000	1,369,000,000	234	15,100,000	1,954,000,000	129
1926	6,096,000	1,416,000,000	232	17,032,000	2,143,000,000	126
1927	6,554,000	1,485,000,000	227	18,794,000	2,299,000,000	122
1928	7,279,000	1,541,000,000	212	19,942,000	2,436,000,000	122
1929	7,439,000	1,593,000,000	214	22,120,000	2,623,000,000	119
1930	8,207,000	1,711,000,000	208	23,843,000	2,799,000,000	117

Dry steam drums are also coming into use on large boilers.

Usually motor-driven centrifugal pumps furnish feedwater to boilers, with a steam-driven unit for reserve or emergency service. Quick starting is an important characteristic of feed pumps. Motor-driven multiple plunger feed pumps will be installed in a new 1,200-lb. plant, where their over-all efficiency of 77 per cent at full load is sufficient justification for their higher cost and greater floor-space requirements.

Feedwater is deaerated or otherwise deoxidized before entering the boilers. Make-up water to high-pressure boilers is generally distilled.

Furnace Equipment—The projected area, fuel-burning capacity and efficiency of underfeed stokers have greatly increased. A recent stoker installation will burn 73 lb. per square foot per hour on 694 sq.ft. at a heat liberation in the furnace of 51,000 B.t.u. per cubic foot per hour. Zoned air control, improved pusher mechanism, better tuyères, water-cooled side walls, deeper ashpits and more rugged clinker grinders characterize the newer units. Heat liberation rates vary from 20,000 to 80,000 B.t.u. per hour per cubic foot of furnace volume with stokers. Forced-draft chain-grate stokers are used for free-burning coals, lignites and anthracite. The largest chain grate has 528 sq.ft. of surface, burns 65 lb. of coal per square foot per hour at maximum output and has a furnace heat release of 42,000 B.t.u. per cubic foot per hour.

The unit system of pulverized coal firing is gaining in favor as it provides a cheaper and simpler plant than the central system. Unit mills up to 50 tons per hour capacity are in operation. Burners are still being improved. Those of the turbulent mixing type give better combustion and require smaller furnaces than the earlier long-flame burners. Systems of boiler control provide instant response to changes in steam demand. Their use lessens labor and over long periods results in higher boiler and furnace efficiencies than could be secured by hand control. Coal is now dried in the pulverizers by preheated air. Vent discharges are delivered to the furnace, thus eliminating former dust nuisances. Many new boilers under which coal with low-fusing ash is burned are provided with furnaces having vertical coal firing and with water-cooled refractory-lined bottoms on which the ash accumulates as liquid slag and from which it is tapped off in liquid form. A greater proportion of the total ash in the coal is retained in the slag than would be deposited in dry-bottomed furnaces.

Recent practice indicates a heat release in powdered-coal furnaces of 12,000 B.t.u. per cubic foot per hour for plain refractory walls, 16,000 for air-cooled walls and 24,000 to 38,000 for water-cooled walls. Average yearly efficiencies of boiler plant of 80 to 88.3 per cent, based upon the higher heating value of the fuel, have been obtained.

The limitation of boiler capacity through the deposit of ash as slag on the tubes above stoker and pulverized-coal furnaces has been overcome by a rearrangement and wide spacing of the first boiler tubes in the form known as a "slag screen." This slag screen cools and hardens the ash particles by absorbing their radiant heat before contact with the tubes, so that the ash passes on as dust.

Ashes and slag are usually sluiced with water from below the furnaces to a central pit. The material which settles is removed by a grab bucket.

Many forms of dust catchers, precipitators and gas washers to remove both ash and undesirable gases are under development to clean chimney discharges, but the problems of cleaning flue gases are not yet completely solved.

Gas and oil are widely used boiler fuels. They offer less combustion difficulties than coal. The extension of natural-gas pipe lines will increase the use of this fuel for power development, particularly for stand-by and off-peak services.

The efficient utilization of waste fuels such as sawdust, wood chips, refinery refuse, etc., for steam production has been greatly extended in recent years.

Steam Turbines—Sixty-cycle turbines operate at 3,600 and 1,800 r.p.m., with a few at 1,200 r.p.m. The capacity of a given casing is limited by the allowable

Table II—Boiler Data on Late American Stations

Name of Station	Year	Manufacturer	Pressure, Lb. per Sq.In.	Temp., Deg. F.	Heating Surface (H.S.) Sq.Ft.	Maximum Rating, Lb. per Hour	Lb. Steam per Sq.Ft. H.S. per Hour	Furnace Volume, Cu.Ft.	Heat Liberated, B.t.u. per Cu.Ft. per Hour	Furnace Bottom
Deepwater	1930	B.W.	1,400	...	9,623	330,000	34.3	19,080	22,640	Slag tap
Huntley No. 2	1930	B.W.	500	765	40,107	560,000	13.9	22,900	38,310	Slag tap
Hell Gate	1930	B.W.	360	770	58,152	1,000,000	17.2	42,500	26,200	Slag tap
East River	1929	C.E.Co.	440	750	60,706	1,250,000	20.6	38,200	29,400	Water screen
State Line	1929	B.W.	800	790	14,735	450,000	30.6	16,700	34,500	Slag tap
Atkinson	1930	C.E.Co.	475	750	30,200	450,000	14.9	25,120	22,500	Air-cooled hopper and hearth screen
South Amboy	1930	B.W.	1,400	750	13,673	275,000	20.1	12,900	26,500	Slag tap
Holland	1929	B.W.	1,400	750	10,122	300,000	29.6	16,500	20,000	Hearth screen
Cahokia	1929	B.W.	330	750	19,836	200,000	10.1	14,650	19,900	Water-cooled hopper
Gorgas	1929	B.W.	475	750	33,805	500,000	14.8	24,000	22,500	Hearth screen air-cooled ash hopper
Gould Street	1927	B.W.	450	720	30,156	519,000	17.2	21,000	33,300	Water screen
Ashtabula	1930	B.W.	395	725	32,560	416,000	12.8	32,560	.....	Water screen
Powerton	1930	B.W.	650	725	30,000	275,000	9.2	13,900	28,000	Slag tap

length of the last blades and by permissible leaving losses. A maximum tip speed of 1,200 ft. per second has been reached, and in certain cases leaving losses have amounted to 7 per cent of the adiabatic heat drop. Single-cylinder units of 80,000 kw. and tandem units of 160,000 kw. capacity, all at 1,800 r.p.m., are in operation. The largest single-cylinder condensing unit at 3,600 r.p.m. is rated at 10,000 kw., while tandem-condensing units of 15,000 kw. capacity are installed at this speed.

Difficulty has been experienced with erosion by moisture in the last rows of blades due to insufficient superheat for the range of expansion. Much attention is being given to this problem. Heavy round-edged

Table III—Performance Data of Certain American Central Stations

Name of station, owner and location	Cahokia, Union Elec. Light & Power Co., St. Louis, Mo.	Hudson Avenue, Brooklyn Edison Co., Brooklyn, N. Y.	Kearny Public Service Co., of N. J., Kearny, N.J.	Ashtabula, Cleveland Elec. Illuminating Cleveland	East River, N. Y. Edison Co., New York, N. Y.	Richmond, Philadelphia Elec. Co., Philadelphia	Trenton Channel, Detroit Edison, Detroit	James H. Reed, Duquesne Light Co., Pittsburgh
1. Operating pressure and temperature	335 lb., 725 deg. F.	279 lb., 415 lb. 602deg.F., 708deg.F.	365 lb., 689 deg. F.	375 lb., 700 deg. F.	385 lb., 750 deg. F.	398 lb., 657 deg. F.	400 lb., 700 deg. F.	400 lb., 720 deg. F.
2. Total installed capacity, kw.	235,000	450,000	214,500	150,000	280,000	120,000	300,000	60,000
3. Unit capacity of turbines and r.p.m.	1 75,000 1 50,000 1 40,000 2 35,000 } 1,800	2 110,000 1 80,000 } 1,200 3 50,000 1,800	3 40,000 2 47,000 All 1,800 r.p.m.	50,000; 1,800	No. 1 and No. 2 60,000; 1,500 No. 4 160,000; 1,500	60,000; 1,800	50,000; 1,800	60,000; 1,800
4. Type and size of steam reheater in sq.ft. H.S.	None	None	None	None	None	None	None	None
5. Number of bleeder heaters	1 to 4 per unit	2 and 4	4	2	3 stages	3	3	3
6. Final temperature of feed, full load, deg. F.	290	285 390	340	190	No. 1 and 2, 344 No. 4, 360	310	250	290
7. Total number of boilers	19	24	15	6	9	12	13	3
8. Sq.ft. of boiler surface per unit	23,500	78,600 98,800	A 12 23,600 B 3 22,900	32,560	6, 18,943 3, 61,451	15,697	30,300	35,025
9. Sq.ft. economizer surface per unit	None	59,900 85,680	None	23,232	None	7,515	18,850	13,572
10. Sq.ft. air preheater surface per unit	2,180	No. 3 173,184	91,400 on B	None	6, 28,900 3, 82,721	22,072	None	None
11. Maximum boiler output per unit, per hour	220,000	Nos. 1, 2, 3 146,000 No. 4 235,000 Nos. 5, 6 312,000	3, 310,000 12, 250,000	416,000	6, 280,000 3, 1,250,000	200,000	350,000	375,000
12. Average boiler plant efficiency per unit, per cent	80.5	Nos. 1, 2, 3 74.3 Nos. 4, 5, 6 84.8	80	87.3	85	88.2	88.3	81.2
13. Type of furnace equipment	P.C.	Stoker	Stoker	P.C.	P.C.	Stoker	P.C.	Stoker Water walls
14. Condenser surface, sq.ft. per unit	53,000	Nos. 1, 2, 3 70,000 No. 6 88,500	3, 43,000 2, 50,000	37,000	Nos. 1 and 2, 47,500 No. 4, 90,000	70,000	3, 31,800 3, 51,000	55,000
15. Maximum cooling water temperature, deg. F.	90	76	89	82	78	84	77	85
16. Minimum cooling water temperature, deg. F.	32	35	34	32.5	32	35	34	33
17. Gross annual output, kw.-hr.	987,512,000	1,555,932,123	1,176,853,500	293,939,000 for 8 months		778,644,811	889,669,400	352,302,000
18. Auxiliary use, kw.-hr.	53,187,000	79,991,391	51,291,180	12,074,000		32,702,042	45,741,400	9,331,890
19. Net annual output, kw.-hr.....	934,325,000	1,475,940,735	1,213,538,500	271,865,000	1,205,165,000	745,942,769	843,920,300	342,970,110
20. Average cost of coal 2,000 lb. per ton	$2.21	$4.08	$4.68	$2.85	$4.08	$4.205	$3.435	$2.25
21. Average annual station performance, B.t.u. per kw.-hr.	15,860	15,460	16,320	13,650	15,850	13,480	14,505	15,020
22. Annual load factor, per cent	60.94	50.75	64	48.5	55.6	74.1	47	55.9
23. Annual use or capacity, per cent	47.9	39.47	52.6	32.3	49.1	74.1	70	65.3

Pressures in lb. gage. H.S. — Heating surface. P.C. — Pulverized coal. Boiler efficiencies based on higher heating values of fuel.

blade sections are used in place of the earlier feather-edged blades. Various blade materials such as stainless steel, nitralloy, heavy chrome-plated steels and blades shielded with tungsten, tantalum and stellite are under trial.

Schemes for removing moisture from the last stages of steam turbines appear to be effective in some units, but of little benefit in others. This problem has not been fully solved.

The Detroit Edison Company's turbine of 10,000 kw. capacity with initial conditions of 375 lb. and 1,000 deg. F. has operated satisfactorily at this temperature. Its performance will in all probability lead to a substantial increase in initial steam temperatures for new plants.

for the period November 30, 1930, to November 30, 1931

Gould Street, Cons. Gas, Elec. Lt. & Pwer. Co., Baltimore, Md.	Long Beach, Southern, Cal. Edison Co., Long Beach, Cal.	Crawford Avenue, Commonwealth Edison Co. Chicago, Ill.	Philo, Ohio Power Co., Philo, Ohio	Powerton, Super Power Co., of Illinois, Powerton, Ill.	State Line, Chicago District Electric Gen. Co., Hammond, Ind.	Lakeside, Milwaukee Elec. Lt. & Pwr. Co., Milwaukee, Wis.	Deepwater, American Gas & Elec. Co. & U.G.I. Co., Deepwater, N.J.
400 lb., 715 deg. F.	410 lb., 750 deg. F.	572 lb., 707 deg. F.	600 lb., 725 deg. F.	630 lb., 725 deg. F.	660 lb., 730 deg. F.	290 lb., 700 deg. F. 1230 lb., 750 deg. F.	1,250 lb., 750 deg. F.
72,000	200,000	424,000	245,000	515,000	208,000	310,800	106,000
2 36,000; 1,800	2 100,000; 1,500 (50 cycle)	No. 1 51,000; 1,800-720 No. 2 60,000; 1,800-1,200 No. 3 50,000; 1,800-1,800 No. 4 75,000; 1,800-1,200 No. 5 88,000; 1,800-1,200 No. 6 100,000; 1,800-1,800	A—2 40,000; 1,800 B { 1 H.P. 2 L.P. 55,000 each, 1,800	No. 1 55,000 1,800 No. 2 55,000 1,800 No. 3 105,000 1,800	208,000, 1,800	No. 2 20,000 1,800 No. 4 30,000-1,800 No. 2 60,000 1,800 No. 4 7,700-3,600	2 53,000 H.P. 3,600 r.p.m. L.P. 1,800 r.p.m
None	None	No. 5 9,000 No. 6 100,000	2, 5,031 2, 4,734	No. 1, 20,856 No. 2, 20,856 No. 3, 32,400	2 heaters, 17,980	Boiler No. 17, radiant, 690 sq.ft. Boilers Nos. 18, 19, 20 convection, 7,800 sq ft.	23,562
4 stages	4 stages	No. 1 unit, 3 stages All others, 4 stages	A 6 stages B 8 stages	4 stages	5 stages 2 heaters per stage	6 units, 1 stage 3 units, 4 stages	4 stages
365	395	No. 1, 315; No. 2, 310; No. 3, 310; Nos. 4, 5, 6, 310	190 330	350	415	360 (4 stage)	434
2	6	No. 1, 4 S and 1 R; No. 4, 5 S No. 2, 4 S and 1 R; No. 5, 6 S No. 3, 4 S and 1 R; No. 6, 6 S	2 reheat 6 stan. } A&B	6 standard 3 reheat	6	Nos. 1-16 305 lb. Nos. 17-20 1,300 lb.	6
Boiler, 30,156 Superheater, 5,771	34,162 per boiler	Nos. 1, 2, 3 15,676 sq.ft. each boiler Nos. 4, 5, 6 17,280 sq.ft. each boiler	A 47,289 B 138,774	Nos. 1-3-total 43,328 Nos. 4-6-total 43,328 Nos. 7-9-total 65,501	Boiler, 10,294 Superheater, 7,200	Nos. 1-8 13,330 Nos 9-16 18,280 No. 17 30,590 Nos. 18-20 28,845	9,623
None	None	Nos. 1, 2, 3 10,250 sq.ft. each economizer Nos. 4, 5, 6 7,376 sq.ft. each economizer	A 35,384* B 94,632	Nos. 1-3-total 12,252 Nos. 4-6-total 12,252 Nos. 7-9-total 41,166	19,820	Nos. 1-8 7,603 Nos. 9-16 14,856	4, 18,320 2, 4,765
26,772	51,232 per boiler	Nos 1, 2, 3 10,000 No. 4 15,670 No. 5 16,000 No. 6 17,780 } sq.ft. each preheater	A none B 423,200	Nos. 1-3-total 84,909 Nos. 4-6-total 84,909 Nos. 7-9-total 164,934	56,401	No. 17 67,300 Nos. 18-20 77,500	42,693
519,000	450,000	Nos. 1, 2, 3 150,000 per boiler Nos. 4, 5, 6 200,000 per boiler	A 508,000 B 2,350,000	Nos. 1-3-total 710,000 Nos. 4-6-total 710,000 Nos. 7-9-total 1,150,000	450,000	Nos. 1-8 90,000 Nos. 9-16 150,000 Nos. 17-20 300,000	4, 350,000 2, 290,000
84.16	84	79.8	A 79 B 81	83.4	84.5	Nos. 1-8 88.35 Nos. 9-16 90.38 Nos. 17-20 86.42	87.5
P.C.	Gas and fuel oil	Forced draft chain grate stokers	A Chain grates B { 6 chain grates 2 P.C. grates	P.C.	P.C. and natural gas	P.C.	P.C.
2 30,000	2 80,000	No. 1 56,000; No. 4 77,000 No. 2 75,000; No. 5 70,520 No. 3 65,000; No. 6 90,000	A 50,000 B 110,000	No. 1 50,000 No. 2 50,000 No. 3 90,000	8 condensers 22,000 sq.ft. in each	2, 35,000 3, 50,000 1, 25,000 2, 55,000	42,500
65	76	75	82	88	80	75	90
34	53.8	34	33	33	40 by recirculation	35	35
321,381,600	1,400,579,800	2,025,283,640	982,765,600	1,217,149,600	1,104,794,000	931,831,245	855,350,879
17,807,000	45,964,258	95,209,400	45,836,920 7,720,800	81,063,700	64,041,000	59,843,015	67,800,000
303,574,600	1,354,615,642	1,930,074,240	929,727,880	1,136,085,900	1,040,753,000	871,988,230	787,550,879
$3.85	Gas, $0.1185 per 1,000 cu.ft., 1,158 B.t.u. per cu.ft.; oil, $0.80 per bbl. of 6,250,000 B.t.u.	$3.69	$1.70	$2.85	$3.80	$4.00	$3.85
14,425	13,268	14,845	13,587	12,823	13,572	13,716	11,850
52.75	86.13	60.4	48	61.5	66.4	47.3	87.0
50.95	77.32	52.0	46	67.1	60.63	34.2	80.0

S — Standard boiler. R — Reheat boiler. *Air - Water heat exchanger.

Disk and blade vibration has been largely overcome through improvements in design. A careful inspection of all blades is now made at the time of the annual overhaul to locate and remove any blades showing fatigue lines or cracks.

The use of a high-pressure oil supply to float the bearings and of motor-driven turning gear has enabled operators to shorten starting time and to eliminate wear of bearings.

Closed bleeder heaters are generally used, but jet heaters are increasing in number. Evaporators to furnish distilled make-up water form part of the bleeder feed-heating system. Deaëration is generally effected in one of the bleeder heaters. Electric generators are provided with air coolers, most of which form a part

Table IV—Comparative Operating Conditions of Mercury Vapor Plants

	Hartford	Kearny	Schenectady
Load on mercury turbine, kw	10,000	20,000	20,000
Speed of mercury turbine	720	900	900
Total steam from unit, lb. per hour	129,000	325,000	325,000
Steam pressure, lb. gage	275	365	400
Steam temperature, deg. F	680	750	760
Mercury vapor pressure at turbine, lb. gage	70.7	125	125
Mercury vapor temperature at turbine, deg. F.	884.5	958	958
Vacuum of mercury condenser, inch absolute	1.5	3.0	3.0
Temperature of mercury vacuum, deg. F	440	485	485

of the feed-heating system. Air-circulating fans are usually fastened to the generator rotor, though separate fans are used with some large generators.

Both high- and low-pressure turbine glands usually have water seals. These require more power than labyrinth packings, but by absolutely preventing steam leakage make-up requirements are decreased and troublesome roof condensation in cold weather is eliminated.

Condensers—A vacuum of 29 in. is specified and secured where cooling water of 55 deg. F. or less is available for the greater portion of the year. In Southern plants with 70 deg. F. water 28½ in. vacuum must suffice. River water temperatures vary widely between summer and winter and this has a considerable effect upon station economy.

Four trends characterize recent condenser practice. Better distribution of cooling surface has increased its effectiveness and lessened the pressure drop through the tube bank. Undercooling of the condensate is prevented by introducing exhaust steam into the hot well. Leakage of cooling water into the condensate has been practically eliminated by rolling both ends of the tubes into the tube sheets, which may be floating or fixed. Effective sub-cooling of the air-pump suction has increased the available vacuum.

Single-pass condensers are favored where ample supplies of cooling water are available at a low head. Two-pass condensers are installed when cooling water is limited or where the lift is high or extremely variable, as on certain rivers and tidal waters. Tube sizes are usually ⅞ in. diameter in single-pass and 1 in. diameter in two-pass condensers. The largest condenser is at the Hudson Avenue station, Brooklyn, N. Y., and contains 101,000 sq.ft. of surface.

The use of welded plate construction for the condenser shell is increasing, as this decreases weight and first cost. Steam-jet vacuum pumps are almost universally used.

Tube surfaces must be kept clean to insure the best station performance. Cleaning by various devices such as scrapers, high-pressure water jets, sand blasting, rubber plugs, etc., is only partially effective. Divided water boxes which permit cleaning in service are also employed. In many plants chlorination of the cooling water to prevent algæ growth in the tubes has proved effective and economical in keeping tubes clean.

Traveling screens are standard equipment on the intakes of cooling water channels. These intakes are located as far below the water surface as possible to draw from the cooler water at the lower depths.

Large quantities of cooling water are pumped per pound of condensed steam due to the higher water temperatures in summer and to the demand for the lowest absolute exhaust pressure consistent with the prevailing load and the leaving losses of the turbines.

Piping—Considerable study has been devoted to the design of piping and valves for high pressures and temperatures and to researches on the flexibility of such pipe systems. Various forms of welded joints for high pressures, such as the Sarlun and the Sargol, and of other joints with gaskets of different metals, are in satisfactory use.

The creep rates and properties of alloys for high temperatures are being investigated in several laboratories and satisfactory materials for use at 1,000 deg. F. will soon be available.

All water, air, gas, oil and low-pressure steam piping is now welded.

Station Performance—Station performance is determined by the economic influences upon the unit cost of power of the price of fuel, load factor and rate of system growth. Moderate load factors and low fuel costs do not warrant large plant investments to secure high thermal efficiency. On the other hand, when fuel costs and load factors are both high, thermal efficiency becomes a major factor, and plants are designed to secure the best possible performance.

The first cost of steam stations per kilowatt of capacity has been decreasing steadily during the past few years and will continue to decrease with the more extended use of both turbines and boilers of large capacity. The cost per kilowatt for stations with steam conditions of 1,200 lb., 800 deg. F. does not appear to be $5 per kilowatt greater than the unit cost of stations for 450 lb. and 750 deg. F. The decrease in fuel consumption of late years in American central stations has been remarkable. From 1919 to 1931 the average coal consumption per kilowatt-hour dropped from 3.2 to 1.56 lb.

Means for reducing power costs

The cost of power consists principally of fixed charges upon the investment in plant and of operating and maintenance expenses. Plant investment can be reduced as noted above. If higher pressures and temperatures are employed fuel costs can be reduced. Unit combinations of one boiler, one turbine will simplify piping and auxiliary arrangements and, by permitting full automatic operation, will lower operating costs. Many turbines are now purchased with most economical load at 60 per cent of rating. This allows a margin for peak load and emergency demands. All unit costs are reduced when load and capacity use factors are substantially increased.

Attention is being directed to the possibilities of reconditioning and increasing the capacities of old sta-

tions. These can often carry the low load-factor portion of the demand at least total cost. Frequently this reconditioning provides added system capacity at less cost than can be secured by any other means.

The elimination of the power house structure to lower first cost of plant is under consideration. Two out-of-door plants are being constructed, one with the boilers unhoused and the other with the turbines outside. The elimination of superstructure may not offer as great an opportunity for cost reduction as simplification of design.

Binary vapor plants

Diphenyl oxide is being circulated through economizers in one of the newer stations and serves to preheat air entering the furnace. It is proposed to use diphenyl oxide in a new station both to superheat the high-pressure steam and to reheat it between cylinders.

A mercury boiler and turbine have operated successfully in series with a steam turbine at one of the plants of the Hartford Electric Light Company. This plant delivered power to the switchboard for a year at an average fuel consumption of 10,250 B.t.u. per kilowatt-hour. Two mercury plants of 20,000 kw. are under construction. One at Schenectady, N. Y., will deliver power to the New York Power & Light Company and will send 325,000 lb. of steam per hour to the works of the General Electric Company. The other, at Kearny station of the Public Service Electric & Gas Company of New Jersey, will deliver steam to turbines in which 33,000 kw. will be generated, thus making, with the 20,000 kw. from the mercury turbine, a total output of 53,000 kw. for the combined mercury-steam unit.

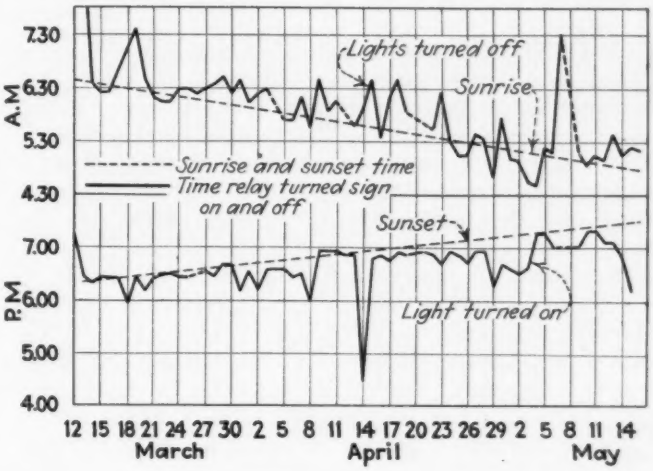
The mercury vapor plant appears to be economically justified on a system where fuel costs are high or where the unit with its accompanying steam turbine can be given a constant heavy loading through the year.

General trend of development

The American central-station plant is still undergoing change and development to increase reliability, simplicity and efficiency. While much has been achieved, many improvements can still be made. Higher pressures and temperatures are now recognized as practical and economically justified. The present trend is toward the production of more kilowatt-hours from every dollar of total expense.

▼

Photoelectric Cell Monitors Sign



Improved control of electric signs is assured by utilizing photoelectric cell switching for on-and-off service, according to a statement of A. Paulus of the Westinghouse company before the recent lighting sales conference of the New England division, N.E.L.A., at Boston. A large roof sign referred to by the speaker is turned on and off by such a cell acting as a relay when the daylight reaches a stated intensity. The accompanying chart shows the time at which the sign was automatically turned on and off during a two-month period compared with switching at fixed sunset and sunrise times. Variations in darkness resulted in a substantial accrued additional period of operation at night and morning, giving the sign owner more complete coverage from the display standpoint and bringing the power company increased revenue.

More Domestic Kilowatt-Hours Must Be Sold

AFTER all the merchandising and sales promotional effort over the past many years by all outlets for electrical merchandise—after all the money, time and effort that have been expended to increase the customers' use of electricity, these figures ($80 to $100 return on $500 invested per customer) still apply rather generally, varying, of course, with different situations and under different controlling conditions, and only about 5 per cent of domestic customers are using over 100 kw.-hr. per month, only about 5 per cent are using between 70 and 100 kw.-hr. per month, only about 10 per cent are using between 50 and 70 kw.-hr. per month.

The facts show that about 52 per cent of the total customers use less than 30 kw.-hr. per month. This is only about 38 per cent of the total domestic kilowatt-hour sales. Just a glance at these figures shows why the investments and revenue figures stand as they are. During 1930, and the same is proportionally true for 1931, the domestic kilowatt-hour sales increased about 13 per cent, while revenues, due to lower rates, increased only about 8 per cent. This points out the extreme necessity for a program to increase the customer's use of electrical home-making helps and the regular satisfied using of these devices—the necessity to seek for business where business is and can be secured.

C. A. NASH,
Vice-President United Light & Power, Engineering & Construction Company.

American Manufacturing 81.8 per Cent Electrified

Purchased energy drives 53 per cent of industrial horsepower.

10,000,000 hp. still directly mechanical.

INDUSTRIAL operations tend not only to use more and more mechanical power but also to apply that power increasingly by means of electricity. While the increase is chiefly in the direction of purchased electrical energy, continued growth in industrial electric power plants is manifested by the statistics on generator rating and the horsepower of motors driven by the energy there generated.

Comparison of figures for 1929, the latest available, with those of the Census of Manufactures for the two preceding enumerations, 1927 and 1925 respectively, reveals several notable differences. Horsepower in manufacturing increased, from 1927 to 1929, by more than 4,100,000 hp., a full 10 per cent; of this, motor horsepower on purchased energy increased by 3,643,354 hp., while only 462,026 hp. was added in prime movers—steam, water and internal combustion.

This progressive mechanization is continually amplifying the power at the disposal of each human worker. It is not appropriate to discuss here the social and economic consequences, though the subject merits thoughtful reflection and planning on the part of every one responsibly connected with industry. But it may be pointed out that in 1925 we had an average of 4.27 hp. per wage earner, in 1927 4.65 hp., in 1929 4.92 hp. That is, the power is steadily increasing, while the change in number of wage earners has been slight, the corresponding figures being 8,384,261, 8,349,755 and 8,742,761. The last applies to a year of exceptional activity; when the results of the 1931 census have been compiled they will tell a different story and the power per worker will make another jump upward.

Meanwhile electrification of those industrial plants that generate their own power is going on at the rate of 500,000 hp. annually. Capacity of private power plants is growing less rapidly. Use of separate motors for individual functions of the driven machine and more liberal margins for peaks are apparently increasing the diversity factor.

Of the sixteen industry groups in the census classification the iron and steel group ranks far ahead of all others in aggregate motor horsepower operated on purchased energy as well as in horsepower driven by energy generated in its own plants (Table II). In proportion to its total power, however, the printing and publishing industry depends most on purchased power (Fig. 1); machinery and the manufacture of transportation equip-

Table I—Prime Movers, Motors and Generators in Manufacturing Establishments, 1929, 1927, 1925

Year	Aggregate Horsepower	Prime Mover Horsepower	Electric Motors Driven by Purchased Energy		Electric Motors Driven by Energy Generated in Establishments Reporting		Electric Generators	
			Number	Horsepower	Number	Horsepower	Number	Kilowatts
1929	42,931,061	20,155,397	2,724,843	22,775,664	852,432	12,376,376	17,270	7,793,875
1927	38,825,681	19,693,371	2,151,675	19,132,310	790,810	11,206,979	19,105	7,366,535
1925	35,772,628	19,903,800	1,724,180	15,868,828	772,445	10,254,745	23,635	6,887,045

Table II—Prime Movers, Motors and Generators by Industry Groups, 1929

Census Group Number	Industry Group	Aggregate Horsepower	Horsepower of Prime Movers	Electric Motors Driven by Purchased Energy		Electric Motors Driven by Energy Generated in Establishments Reporting		Electric Generators	
				Number	Horsepower	Number	Horsepower	Number	Kilowatts
	All groups, total	42,931,061	20,155,397	2,724,843	22,775,664	852,432	12,376,376	17,270	7,793,875
1	Food and kindred products	4,607,913	1,775,938	356,621	2,831,975	67,938	642,530	2,854	475,695
2	Textiles and their products	4,145,998	1,989,325	486,793	2,156,673	160,246	1,044,623	2,546	973,891
3	Forest products	3,674,204	2,421,861	161,803	1,252,343	75,085	900,862	2,038	634,028
4	Paper and allied products	3,166,804	2,207,352	68,591	959,452	53,177	1,248,776	1,499	968,021
5	Printing, publishing and allied industries	649,441	43,245	255,791	606,196	8,468	31,002	167	22,615
6	Chemicals and allied products	2,312,295	1,084,146	102,966	1,228,149	53,939	553,039	1,130	451,509
7	Products of petroleum and coal	1,755,258	1,142,158	26,509	613,100	22,031	604,471	463	332,507
8	Rubber products	821,312	248,949	33,266	572,363	11,882	240,921	134	150,569
9	Leather and its manufactures	436,342	200,648	59,127	235,694	15,781	119,994	545	110,021
10	Stone, clay and glass products	2,854,402	1,055,645	96,430	1,798,757	29,615	812,862	1,019	579,134
11	Iron and steel and their products, not incl machinery	9,200,822	5,408,676	222,667	3,792,146	130,512	4,106,875	1,573	1,761,940
12	Nonferrous metals and their products	1,570,217	517,169	97,620	1,053,048	23,635	343,572	446	252,357
13	Machinery, not incl. transportation equipment	3,647,343	831,910	393,554	2,815,433	101,601	793,463	1,389	480,461
14	Transportation equipment, air, land and water	2,271,192	562,544	196,548	1,708,648	49,949	481,682	440	310,072
15	Railroad repair shops	1,153,147	442,112	47,460	711,035	19,766	278,247	562	179,664
16	Miscellaneous industries	664,371	223,719	119,097	440,652	28,807	173,457	465	111,391

ment follow. Iron and steel leads in per cent of operation on privately generated electrical energy, followed by the paper group.

Lowest percentage of electrical operation is reported for the forest products, the coal and petroleum products and the paper-making groups. The first of these is the only one having less than 60 per cent of its total horsepower in electric motors.

Every group, with the exception of textiles, increased its installed horsepower in 1929 compared with 1927 (Fig. 2). The apparent decrease in "Miscellaneous" was probably caused by changes in classification which would naturally affect this residual group. Information on this point is not yet available.

For the electrical industry the commercial significance of these statistics may be viewed in several aspects—that of the seller of electrical energy, that of the electrical manufacturer and that of the engineer and installer of equipment.

The first of these is concerned with two factors, the horsepower of motors driven by purchased energy and the extent to which they are operated. In periods like the present, with many plants partly idle, there is little encouragement in knowing that the installations exist. But that condition cannot last forever. These motors will again in due season be in full operation. The fact remains that of nearly 43,000,000 hp. in American mills and factories less than 23,000,000 hp. is driven by purchased energy. The remaining 20,000,000 hp. constitutes to a greater or less degree a potential market for energy. In addition there is the steady increase that has occurred in the past and that will presumably be re-established.

To the other parties at interest, electrical manufacturers, engineers and installers of equipment, it may be pointed out that aside from net growth the statistics reveal a considerable, though not measurable, amount of rebuilding and replacement. Thus while the rating of the generators in private plants has been increasing their number has rapidly diminished. This could happen only by the substitution, on a rather extensive scale, of larger for smaller units, not revealed in the net growth of generator capacity.

At the same time the average horsepower per motor has been shrinking. Apparently a transfer is taking place from group drive for a number of machines or a number of operations to the performing of the same functions by several smaller motors. Here again the magnitude of replacements is not revealed in the net increase.

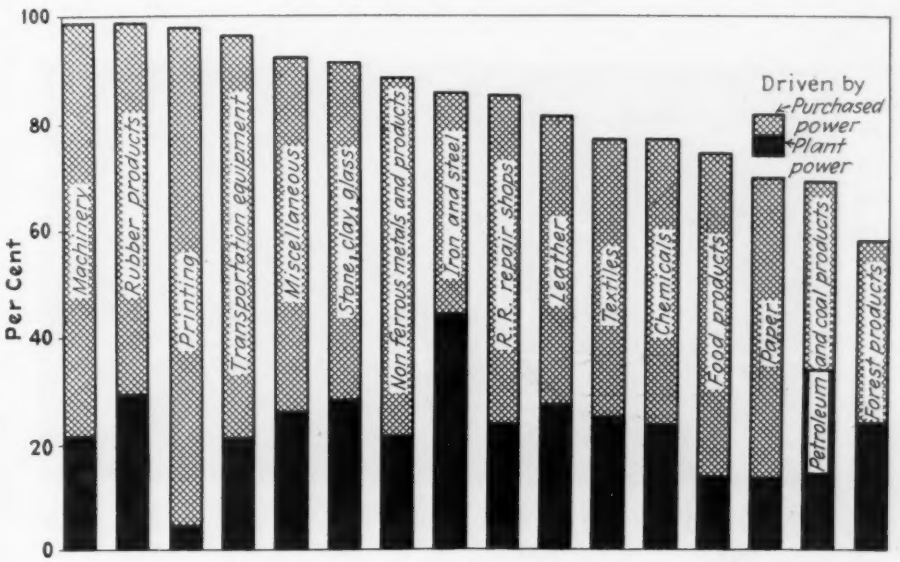


Fig. 1—Electric motor horsepower in per cent of total horsepower by industries

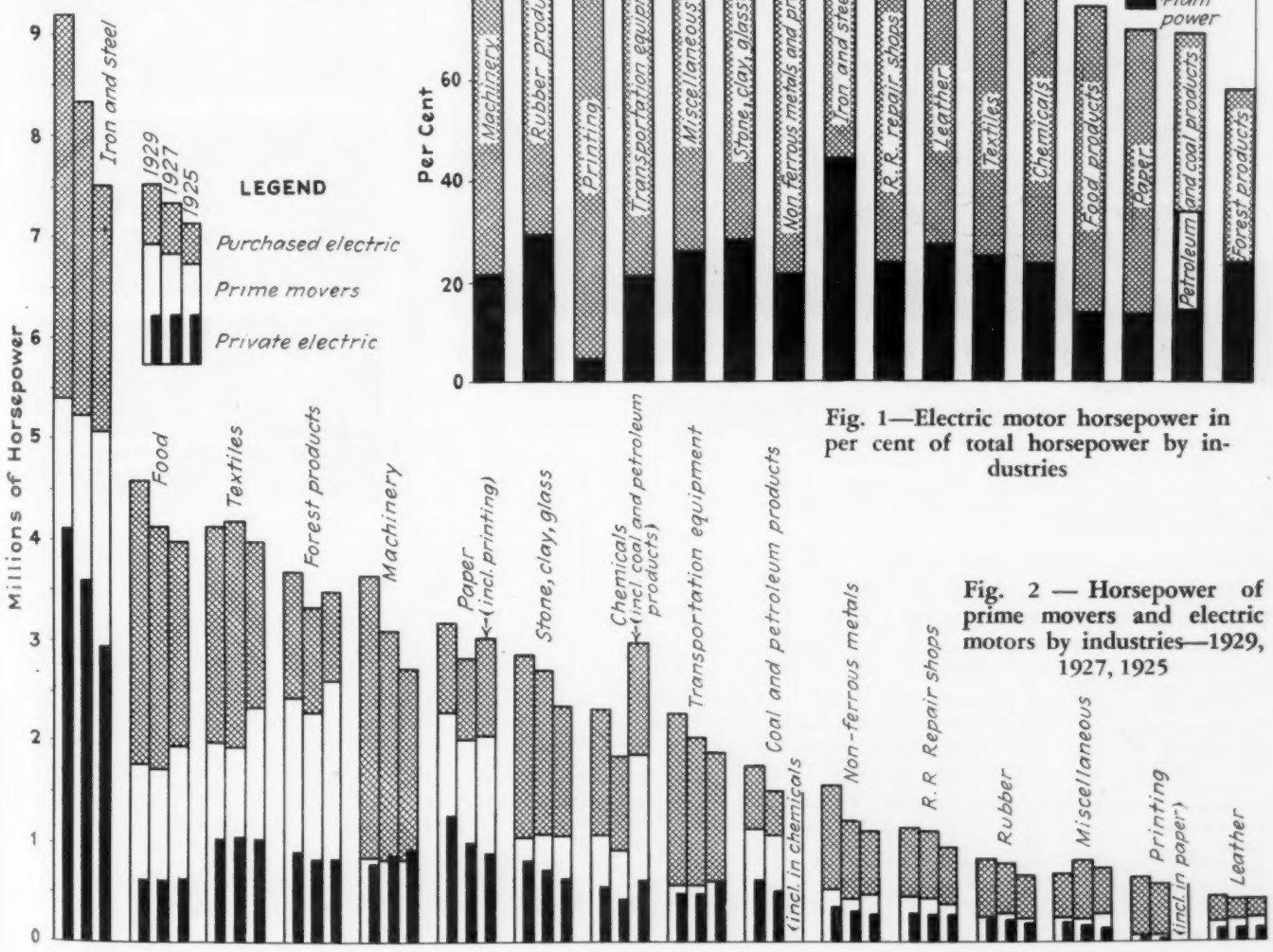


Fig. 2 — Horsepower of prime movers and electric motors by industries—1929, 1927, 1925

June Operations Change Normally

INDUSTRIAL activity in June, computed on the basis of electrical energy consumption in various branches of manufacturing as reported to the ELECTRICAL WORLD, was on a level about 5 per cent lower than in May. Such a change is not abnormal; the decrease is smaller than it was for the corresponding months of 1931, when it amounted to 7 per cent; in other years, also, a downward movement has been observed at this season.

The unusual feature is the extremely low point to which the average of manufacturing activity has now fallen, namely, 22 per cent below the average for the reference period, 1923-1925, and 24 per cent lower than in June, 1931.

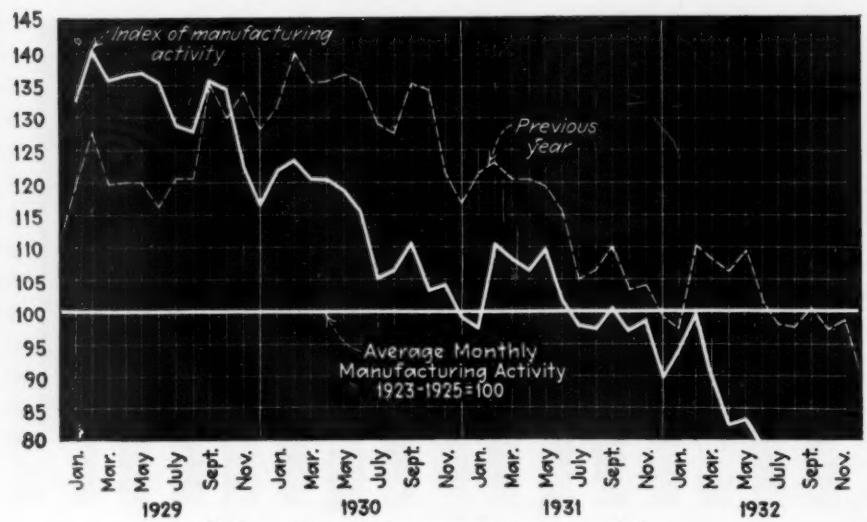
While the downward change was general there were two groups that moved against the trend. Food products scored a modest rise; rubber manufactures advanced sharply.

Changes in this latter group were striking, not only in magnitude but in the large number of plants reporting an increase. In the country as a whole the gain from May to June was a full 25 per cent; in the Middle West, where much of the industry is concentrated, the gain was somewhat greater; in New England, the secondary center for the industry, it was smaller. At least one large plant increased operations 30 per cent; several went as high at 20 per cent.

The automobile industry, receding only 5 per cent from May, held up much better than last year, when it dropped 20 per cent; it continues lower than in 1931, but is now within 8 per cent of operations at the corresponding period last year.

Against these more or less favorable indicators, the textile industry has again sagged and is now 45 per cent lower than it was a year ago. New England mills averaged 20 per cent under May, although the latter was a shorter working month because it contained a holiday and five Sundays. In the Middle Atlantic States the reduction was 25 per cent; only the Southern mills indicated a gain, but it was less than 2 per cent.

Both metal groups declined further and continue lower even than last year. Similar changes, though on higher levels, occurred in the paper and pulp, forest products and stone, clay and glass industries.

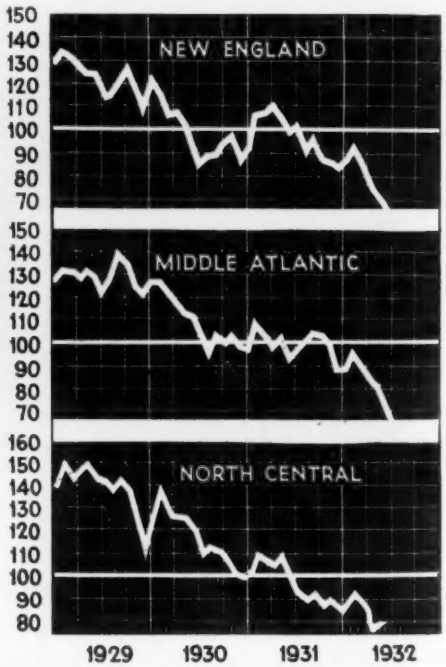


Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100.

(Corrected for number of working days, but not for seasonal variation.)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.



Industrial Group	United States June, 1932	United States May, 1932	United States April, 1932	United States June, 1931	New England June, 1932	New England May, 1932	New England April, 1932	New England June, 1931	Middle Atlantic June, 1932	Middle Atlantic May, 1932	Middle Atlantic April, 1932	Middle Atlantic June, 1931	North Central June, 1932	North Central May, 1932	North Central April, 1932	North Central June, 1931
All Industry	77.6	82.0*	82.2	101.7	67.3	71.0*	73.2	98.4	68.5	78.5*	80.7	91.5	80.2	82.7*	79.3*	99.2
Automobile (including parts and accesories)	65.9	69.3*	64.4	71.3	.....	.....	.....	.....	50.1	66.2	61.7	65.6	65.0	69.0*	64.3	72.0
Chemical products (including oil refining)	123.8	129.9*	118.9	132.7	144.0	149.8*	152.9	165.1	131.0	138.2*	131.9	131.3	116.2	119.0*	112.3	144.2
Food products	118.4	116.3*	116.7	136.2	.....	.....	.....	.....	94.9	92.3*	85.3	109.5	123.7	119.7*	118.0	144.9
Iron and steel	55.8	61.8*	64.9	86.6	77.5	78.8*	91.4	115.3	49.2	52.1*	58.3	81.0	57.8	66.2*	65.4	89.3
Metal working	52.5	55.8*	57.2	78.6	66.0	71.5	71.8	97.4	49.8	54.5*	64.4	68.6	53.2	54.7	51.2	76.8
Leather products	65.7	74.7*	75.6	85.4	61.2	60.8*	67.0	71.6	80.2	97.8*	83.1	108.1	51.8	59.7*	74.1	78.6
Forest products	70.0	77.8*	76.0	86.3	43.2	41.8*	40.1	49.4	47.7	62.7*	59.5	68.1	74.1	80.8*	87.5	96.9
Paper and pulp	96.5	102.7*	105.5	112.4	108.3	109.4*	108.0	149.6	60.2	67.5*	71.0	68.0	94.2	99.2*	93.5*	109.5*
Rubber products	120.7	95.5*	88.3	121.0	89.7	84.2*	86.0	93.4	.....	.....	.....	.....	126.4	96.9*	93.4	139.5
Shipbuilding	85.1	86.8*	91.1	84.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone, clay and glass	86.1	97.9*	96.4	118.7	.....	.....	.....	.....	73.2	85.7*	81.3	99.5	110.0	118.3*	84.2	94.4
Textiles	55.2	62.8*	69.2	100.5	42.0	48.2*	48.4	83.2	58.0	80.2*	87.8	101.0	77.8	91.5*	98.4	105.4

*Revision.

Fusing of Voltage Transformers

Use of fusing exceeds practice of omitting fuses.

Protection of service takes precedence over protection of transformers.

Operating engineers more favorable to fuses than instrument engineers.

Manifest need is disclosed for fusing standardization.

WHETHER to fuse the primary and secondary leads of voltage transformers is, from the standpoint of practice at least, an open question. Equipment manufacturers recommend fuses on both sides of voltage transformers used with power switchboards (N.E.M.A. rule SG 4-56). The utilities in the N.E.L.A. meter committee report of 1930 and elsewhere in print have viewed the use of primary fuses as desirable "under certain operating conditions," but not generally to be recommended. Fuses in the secondary are occasionally frowned upon rather strongly in these statements because the risk of poor fuse contacts and corrosion endangers accurate metering. Here already is indicated enough lack of unanimity to justify an inquiry. Questions were asked of 24 companies and detailed answers were received from companies representing more than 14,000,000 kw. of capacity. The inquiry reveals a considerable amount of disparity fringing a small central core of common thought on this topic.

In the first place, there is general agreement on the point that the function of the primary fuse is to protect service continuity against failure of the instrument transformer. There is very little disagreement on this point among the system operators and meter and relay engineers who were queried. However, there is some doubt whether primary fuses will clear a voltage transformer which has suffered only a partial breakdown of even its primary winding. The primary fuse is not used to protect the transformer itself, except possibly for the lower voltage installations. Hardly any one appears to believe that primary fuses are effective against excessive burdens on the secondary side or much more so against even secondary short circuits; the latter is the job of the secondary fuse. These opinions are equally true of primary fuses used in conjunction with resistors in series.

Fusing more common in 11-22-kv. range

Normal currents in even the secondary circuits of voltage transformers are quite small, and on the primary side this is more pronouncedly the case the higher the voltage involved. The consequence is that the fuse under these circumstances is not viewed as meeting tasks like those assigned to fuses on ordinary mains and branches of distribution circuits. The fuse in the instrument circuit would have to be mechanically frail to melt on currents only slightly above the normal values of current in the voltage circuits of instruments. Its function, therefore, is to clear the circuit for values which are a large multiple of the normal value. "We make no effort to fuse the primaries of voltage transformers above 46 kv. Fuses small enough to protect the windings are usually mechanically unreliable and likely to blow on secondary short circuits, which is something to be avoided," was a remark in one of the replies.

Another fairly definite consensus is that fusing is more resorted to in the moderate voltage range (11 to 22 kv.) than in the higher voltages (66 and 132 kv.) or than in the lower range (2, 4 and 6 kv.). It is apparent that this is attributable to a general tendency to use fuses at the generating stations or switching stations considerably more than at consumers' substations. Another basis for decision rests on whether the voltage transformer is connected on the bus side or line side of circuit breakers. There are evidently many who are fusing the voltage transformers if they are on the bus, but not if they are on the line. Here the desire to protect the reliability of the system against the failure of the voltage transformer dominates, the hazard being less out on the line than on the bus.

More specific bases for the varying aspects of practice and for those factors which explain such uniformity as exists can be found in the comments which qualify the detailed answers to the inquiry:

1. Do you fuse primaries of 11-kv. and 13-kv. voltage transformers?

Yes, 15. No, 1.

The affirmative answers here are qualified in several ways. Three respondents said "yes" for power plants and substations but not for consumers' substations. Another "yes" did not apply to metering units. Three mentioned that their "yes" applied to voltage transformers on the buses only and not to those connected on the line side of station and substation breakers. Manufacturers' replies are not enumerated here or elsewhere, but the preponderance of field practice appears to agree well with the N.E.M.A. rule.

2. Do you fuse the primaries of 66-kva. and 132-kva. voltage transformers?

Yes, 9. No, 8.

There were more qualifying remarks here: "Yes for indoor stations, no for outdoor stations." "Yes, except when on the line side of circuit breakers." Another "sometimes on buses, not at all on lines," while another reports just the opposite, "used on lines only." One, not recorded in the above tabulation, says "yes" on 66 kv. but "no" on 132 kv. On the other hand, one reply, included in the nine yeses, said "yes in all cases for 66 kv. and 132 kv."; the same utility company in answer to question No. 1 on 11 kv. and 13 kv. said "in most cases for 11 kv. and 13 kv."

Manifestly there is less disposition to fuse the voltage transformers on higher voltages, although one answer was wholly contradictory to this trend. In view of the more general agreement on the greater necessity for pro-

tection of the system when the voltage transformers are connected to the bus and the greater likelihood that the higher voltage installations will be at the generating and switching stations than at consumers' substations, the inference is unavoidable that there is considerable doubt about the efficacy of the fuses available for the higher voltages. Certainly there is more reason to protect the higher voltage systems because of their greater importance. But short-circuit kva. is in general larger here and the duty on the fuse grows accordingly. It seems fairly clear that fuse manufacturers need to persuade the users that available fuses will be efficacious, especially when used with the current-limiting resistors, on the higher voltages.

Resistors used extensively in primary

3. Do you install current-limiting resistance in series with fuses in the primary circuits of voltage transformers?

Yes, 14. No, 3.

On this point there is a relatively high degree of uniformity in practice. Recognition of the function of the resistor—to limit the short-circuit current to the rupturing capacity of the fuse—was embraced in several of the affirmative answers. However, several of the "yes" replies were qualified in various ways which show a diversity of conditions or of thinking. Thus one said "yes on 6.6 kv. and 13 kv.," another "yes for 13 kv. and 33 kv." and still another "yes for 132 kv. only." One answer, recorded as negative, was "not ordinarily"; the same company answered question 1 "only when connected to a bus." Another negative said "seldom." One answer, not entered, said "at our newer generating stations yes, at other locations no."

4. At what value of current are primary fuses expected to blow?

Actually, the question was asked "at what multiple of exciting current are the fuses expected to blow?" There is, of course, no inherent relation between the magnitude of the true exciting current and the permissible value of primary current under faulty conditions. "The high-tension fuses bear little or no relation to the exciting current of the transformer. We ordinarily use the smallest fuses obtainable, consistent with reasonable mechanical reliability." Other answers were more specific.

Current rating of fuses varies over considerable range

Three reported using ½ amp. rating. One mentioned ½ amp. up to 36 kv. and 1 amp. above that voltage. Two said it was determined by the value of the burden, one stating that the fuse was rated to blow a three to five times normal primary current with full secondary burden. Others reported 0.2 second blowing with 30 to 100 times open circuit exciting current. Five amperes is the smallest rating used by one company. In another instance the rating "Is a safe multiple to prevent unnecessary blowing." In still another case the rating of the fuse "depends on the capacity of the stations, not on the rating of the voltage transformer."

5. If you use a series resistor, to what multiple of normal primary current is it calculated to limit the fault current?

The preponderance here (eight of the fifteen and nine who reported using fuses for some voltage) is to fix the ohms of resistance at a value which will limit the current to a value below the rupturing capacity of the fuse. Others undoubtedly had this criterion in mind when they gave various numerical answers to the question, intentionally asked on a basis that was known not to be the ruling one. As for limitation to a multiple of normal current, various values were cited, 600, 4,000, 4,840, "several times." One said 60 ohms on 13.8 kv., another reported 60,000 ohms without mentioning the voltage.

Accuracy for metering and relaying in question

It is safe to say that without the resistor the short-circuit current which the system can deliver through the fuse to a fault beyond it is often likely to exceed the interrupting capacity capable in a fuse which will blow at sufficiently low values of fault current. The general impression has been that the requisite value of resistance will not seriously affect in an adverse way the metering accuracy of the transformer. Several answers indicate a strong opinion to the contrary, so much so in one case as to fix the practice of limiting the resistor ohms to a value which will not interfere with metering accuracy, especially for billing purposes. This point evidently needs more explication.

6. Do you fuse secondary circuits of voltage transformer?

Yes, 77. No, 6.

The vote recorded is not adequately indicative of the practice, however. Ten gave the answer "yes" for both secondary and primary fusing. Five use fuses on the primary but not on the secondary. One does not use fuses on either side of the transformer. Two recorded as "yes" above restricted the answer to "stations only." One, recorded as "yes," said "on 11 kv. and above." Another recorded as "yes" said "seldom on relays; always use pilot lights if relays are used" in order to call attention to a blown fuse. Two other answers indicated a divided practice—"generally no" and "in some cases." One, not recorded in the tabulation, said "no when used for relays and metering, yes when used for potential indicators, reclosing relays, synchronizing and miscellaneous."

7. If you use secondary fuses, what determines the rating?

The greatest uniformity here is on the point that the fuse is not intended to be protection against an excessive working burden, but against short circuits on the secondary leads; consequently they use "a small size." The actual ratings reported range from 3 to 30 amp. or more, with 5 and 10 amp. mentioned in several instances. One says "5 amp. where relaying is not important, 10 or even 30 amp. if it is important." Another says, "10 amp. on instruments and 30 amp. on relays." In two instances the burden was cited as the determining factor, but two others fix the fuse rating at five times the secondary current rating of the voltage transformer. From two quarters comes the answer, "ability to provide reasonable protection without tendency to develop high circuit resistance." Two correspondents, not bound by tradition, use 30-amp. fuses but "do not like fuses, would like to try 'No-Fuz' devices."

8. Do you believe that fuses and resistors in the primary circuit are adequate protection against

(a) Partial primary breakdowns?			
Fuses alone	Yes, 6.	No, 9.	
Fuses and resistors	Yes, 8.	No, 8.	Doubtful, 1
(b) Excessive burden?			
Fuses alone	Yes, 1.	No, 14	
Fuses and resistors	Yes, 2.	No, 14.	Doubtful, 1
(c) Secondary short circuits?			
Fuses alone	Yes, 3.	No, 11.	Doubtful, 1
Fuses and resistors	Yes, 6.	No, 11.	

Certainly here the skeptics have it, but only by a close margin in the case of primary breakdowns. The majority thinking is apparently that the function of the primary fuse is to protect the system against a major fault. Its function is not well performed in protecting the transformer against overloading or against its own incipient faults. The high impedance of the voltage transformer primary even makes it doubtful in the minds of many whether it can be effective in protecting the transformer against the overloading that would attend a secondary short circuit.

There are alternatives available

European practice presents an alternative at this point in the Buchholtz scheme of protection which can be adapted to voltage transformers provided with conservators. It is based on the theory that any kind of fault—broken joints in the wires, grounds and shorts between turns, secondary overburdens or short circuits, defective oil, structural eddy currents—will create internal heating. Gas and vapor will sooner or later result and the accumulated pressure is employed in a mechanical device which operates a relay to trip the transformer off the line before it has been seriously damaged or has involved the line into a fault.

Still another alternative is of course to avoid voltage transformers entirely by resort to bushing potential devices which function on the condenser principle. A paper by P. O. Langguth at the recent A.I.E.E. summer convention in Cleveland ("Relay Operation from Bushing Potential Devices") demonstrates that such devices can be given accuracy for relaying purposes comparable to that of the voltage transformer.

More detailed analysis would promote uniformity

The companies were asked to cite favorable and unfavorable experience with both the omission and the use of fuses. Several reported no unfavorable experience with fuse protection provided the primary fuse is fortified when necessary by a resistor and is not relied upon for clearing secondary trouble. One went so far as to say "excellent results have been obtained with fuses and resistors." Another said that the troubles were of such a nature as to indicate that primary fuses, primary resistors and secondary fuses would have obviated whatever difficulties they had with voltage transformers.

On the unfavorable side there are cases of voltage transformer failures which lead to explosions, fires, bus faults and service interruptions. Certain cases were attributable to the use of fuses without resistors to keep the inrush to values which the fuses could handle. One report said "trouble both from inserting and omitting primary fuses, but no trouble with the resistors." On the secondary side some of the troubles involved interrupted metering and relay action from blown secondary fuses; this would indicate a larger size to be desirable. Others had damage to transformers from a secondary fuse size too large to blow on the overcurrent values experienced. There is also the responsibility to examine secondary fuses frequently to eliminate high contact resistance. Primary resistances have failed from turn to turn or to ground just at the moment when they were being relied upon to limit the spread of trouble. Many of these reported troubles undoubtedly antedate the period in which considerable advance has been made in design of both fuses and resistors as well as in the technique of applying fusing on both sides of voltage transformers.

On the whole, there are several conflicting influences at work to prevent the manifest uniformity in practice that is shown to be lacking by this study and which could unquestionably be aided by a fuller discussion of these factors on a quantitative and comparative weighting basis. The hazard from omitting the fusing appears to outweigh greatly the uncertainties that attend the use of fusing. Additional study is evidently needed to clarify the technique which will reduce the uncertainties and compose the conflicting requirements of the different operating departments—system operation, protection and metering.

It is unquestionable that a more thorough discussion by manufacturers and users of the quantitative factors that dictate judicious choice of fuse and resistor ratings would clear the atmosphere so that the benefits from using fuses would be allowed free play without fear of uncertain results in clearing faults and at the same time preserve continuity and accuracy of metering and relaying. Much practice appears to have been based on the characteristics of the specific system where the question of fusing arises. There seems, however, to be no standardized practice which fixes the fuse and resistor ratings in terms of the voltage, the system kva. that can flow into the fault and the magnitude of burden on the voltage transformer.

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Malden Saved by Buying Power

The Malden (Mass.) Electric Company saved $278,587 in 1931 by purchasing electricity from the interconnected Eastern Massachusetts Electric Company system, in comparison with generating this energy in a new 45,000-kw. steam plant, according to President A. B. Tenney when speaking before the Massachusetts Department of Public Utilities in a recent rate hearing. How this was done appears in the following simple tabulation of costs:

Estimated cost of a new 45,000-kw. steam plant		$4,620,000
Production Expenses		
70,500,000 kw.-hr. at 6 mills	$423,000*	
Depreciation 4 per cent	184,800	
Taxes, 90 per cent of plant cost, at $30.80 per M	128,066	
Transmission expense at 1 mill	70,500	
Total operating cost	$806,366	
8 per cent return on $4,620,000	369,600	
Total	$1,175,966	
Present cost of energy bought	897,379	
Net saving by purchasing	$278,587	

*Production cost of similar plant in 1931 was 6.71 mills per kilowatt-hour.

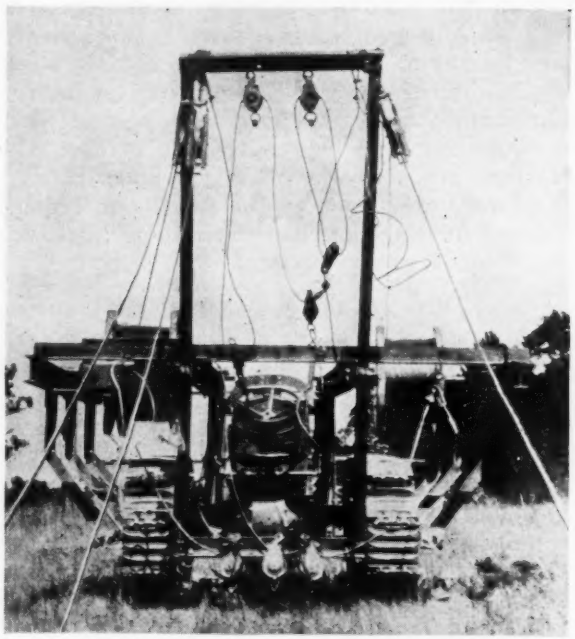
Erecting Poles with Conductors Attached

By W. B. FLYNN

BUILDING transmission lines without climbing the poles and "sagging" the conductors before erection may seem a little unusual to those familiar with the standard methods of line construction, but this method has been used in recent years for both transmission and distribution lines by one company in the Southwest. Elimination of the relatively hazardous work of pole climbing and of working in the air on crossarms is a step forward to improve safety conditions and should result in a reduction of accidents.

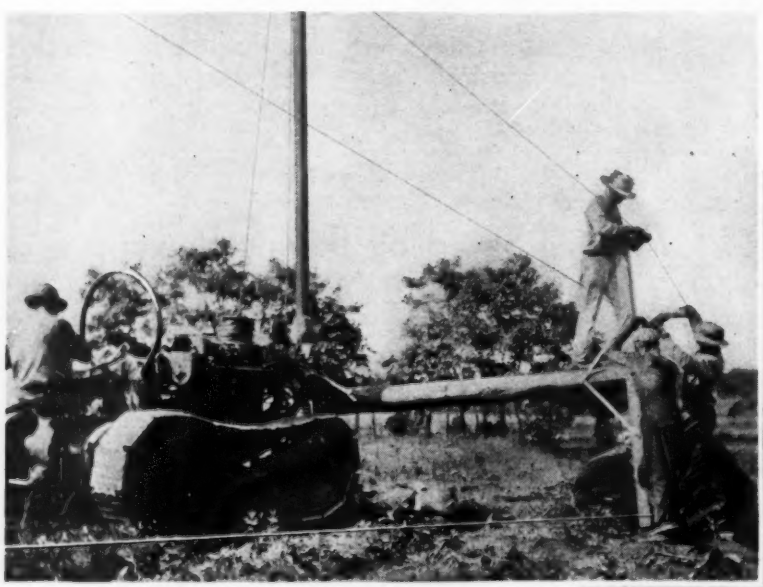
Poles are delivered to the right-of-way with their tops to the stakes and placed across the right-of-way, instead of parallel to the line. There the poles are completely framed and all attachments made, including guys and special equipment.

All the conductors are strung at one time, using a wire-stringing tractor. This consists of a standard caterpillar tractor having mounted on it a steel frame arranged for carrying four or six reels. An equalizer is provided for maintaining uniform tension in all cables; it consists of a vertical steel frame with two fixed steel cable blocks at the top and three movable blocks attached



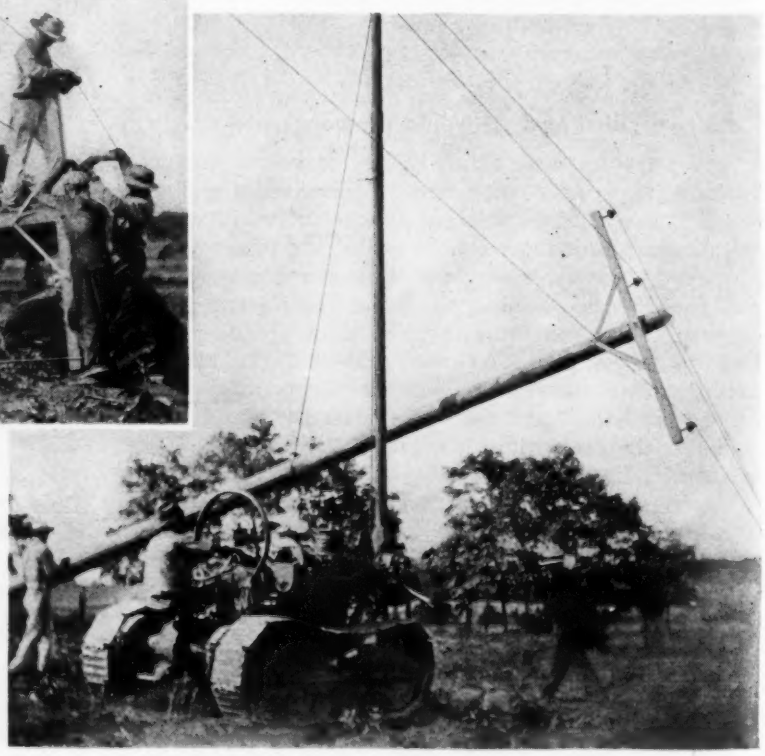
Stringing tractor feeding out three conductors at once

Equalizer frame, in rear for pulling conductors to equal tension, with come-alongs, cables and blocks at bottom. Dynamometer is not shown.



Tying-in conductors pre-strung to final tension

Each man ties the conductors at marks made on conductors to allow for offset of insulators. Note heavy safety guard for operator of pole erector.



Pole with all conductors attached being hoisted into place

The pole is being guided into place, while the foreman goes ahead to check alignment before backfilling the hole with dry sand from bags in front of tractor.

to come-along cables, which are carried through three blocks at the bottom of the frame. Flexible steel cable is reeved through these blocks with the cable ends clamped to the top of the frame. A dynamometer is connected into one of the three come-along cables to indicate the stringing tension.

The stringing machine advances about five spans (1,500 ft.) ahead of the pole-erecting crew, stringing the conductor on the ground. The come-alongs on the equalizer are then attached and the conductors pulled to required stringing tension as shown on the dynamometer. The stringer holds its position till the pole-erecting gang advances to the next adjacent pole and then moves ahead again, about five spans. With large conductors, strung at heavy tensions, it is necessary to transfer the load temporarily to anchors during the advance of the machine.

The hole digger and pole setter lines up at the stake ready to dig the hole and raises the pole sufficiently to rest it on the end of the crossarm about 6 ft. from the stake. The conductors, having been previously marked to show the exact position of the insulator tie (making proper allowance for the offset of the insulators, forward or backward), are then raised to the proper insulator and tied in at the marks. The crossarm is held plumb while tying in to insure the arm setting at right angles to the line when erected.

While this work is being done the hole digger excavates the hole. The pole is then raised, with all conductors attached, and the butt is carefully guided into place. The pole is plumbed and partially back-filled. It has been found that considerable time is saved by using dry sand in bags, as it quickly settles in the hole and allows the immediate release of the pole-setting machine to proceed to the next location. Completion of the back-filling and tamping is done while the machine is setting up at the next stake.

A crew of eight men is required, consisting of a foreman, pole-setter operator and two men, cable-stringer operator and helper, pole framer and helper. On tangent and level right-of-way this crew completely erects 2 miles of line per day, and averages, for the usual line, about 1½ miles per day.

All framing and cable work for transformer poles, for corner poles and for metering poles is fully completed on the ground before erection, thus saving considerable time, as the men can work more efficiently and expeditiously on the ground.

Costs—It is difficult to say exactly what saving can be made by this method as so many variables make comparisons of methods difficult, no two lines being exactly alike in all conditions.

For 12-kv. with 30-ft. creosoted yellow-pine poles, on 300-ft. spans and 8-ft. cross-arms, No. 2 A.C.S.R. on rolling, sandy right-of-way, with occasional gullies, the cost of distributing materials, the labor for erection (not including clearing right-of-way), supervision and field overhead were $306 per mile for an 8-mile line and $308 per mile for a 12-mile line. The following labor and machine rates were used:

1 foreman, per month	$200.00
1 lineman, per hour	$0.70
2 helpers, per hour	$0.50
2 laborers, per hour	$0.30
Pole setter, including operator and gasoline, per hour	$1.25
Wire stringer, including operator and gasoline, per hour	$0.90

Advantages—Aside from the possible saving in construction costs and speed of erection, there are many other advantages in this method:

(a) Small crews of six or eight men may be used, thus avoiding the disturbance caused by large construction crews in small communities.

(b) The line can be fully completed as the work progresses so that re-entry to the right-of-way is unnecessary, causing less disturbance to adjacent property owners.

(c) Specialized work for each member of the small crew leads to greater efficiency and co-operation and more intelligent operation of tractors in cultivated districts, resulting in low crop damage.

(d) Improved working conditions due to elimination of pole climbing, which should reduce lost-time accidents.

Application—Careful study should be made of each proposed line before selecting this method of construction, as there are many things to consider and also many cases where this machine method of erection may not be economical.

For rocky right-of-way, having deep gullies, requiring the construction of temporary bridges, or for short lines or distant lines, requiring long hauling of this special equipment, it is doubtful whether this method will show a saving.

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Electricity Has Leading Rôle in Steel-Mill Problems

Electricity is destined to play a leading part in the solution of steel-mill problems, whether they involve heating, rolling, annealing, welding or transportation, declared W. H. Burr, Lukens Steel Company, speaking before the Association of Iron and Steel Electrical Engineers recently. After this depression is over the benefits derived from the lessons learned will no doubt result in greater achievements than ever before.

Citing achivements of the past year that have special significance to steel men, Mr. Burr said in abstract: "There is the possibility that 60,000-kva., 3,600-r.p.m. turbo-generator units can be developed if external fans and aluminum field coils are used; 3,200-lb. steam pressure is being considered and 133-cycle generators are being used by DuPont; new mercury-vapor power plants are being built for Kearny, N. J., and Schenectady, N. Y.; Chicago will have a 75,000-kva. synchronous condenser; New York has a 70,000-kva., three-phase transformer, and Baltimore a 42,000-kva. surge-proof transformer.

"One-half the number of main roll drives were sold in 1931 as in 1930. Induction motors rated as high as 7,000 hp. are being built. Voltages up to 11,000 are being used for a.c. drives. Motors for strip and hoop mills constitute half of the total sold recently, cold-roll and merchant mills ranking second and third respectively.

"Direct-current drive was recently selected for a single-stand, cold-roll mill and tension reel for sheet and tin plate, for a three-stand tandem cold-roll mill for high-grade alloy, for a three-high universal plate mill in the South, for some 72-in. continuous hot-strip and cold-

strip mills in Cleveland and for a 'push bench' for producing seamless steel tube.

"Induction motors were selected for another 72-in. continuous hot strip mill. Three 1,250-hp., 2,200-volt motors were installed for across-the-line starting and two-pole, slip-ring motors are now made up to 300 hp.

"There has been an increased use of part-winding starting for synchronous motors on main mill drives."

Reference was made to the hydrogen-atmosphere electric furnace which prevents oxidizing when annealing steel sheets.

Considering new auxiliaries, Mr. Burr referred to rolling strip steel with a constant tension by the use of direct-current motors that require no relay to maintain constant current. Under a.c. auxiliaries reference was made to squirrel-cage motor applications heretofore considered impossible, low inertia motors with 8 to 10 per cent slip for presses and shears, operation of 1-hp. d.c. shunt motors from 25 cycles with perfect speed control by using four thermionic tubes, 25-hp. high-speed motors that can be carried by one man and special motor reducers applied to hotbed rollers of strip mills.

Among developments in the control field were mentioned the "photronic" disk which operates relays without auxiliaries or battery, grid-glow tubes, 900-kw., 5,000-volt power tubes, automatic screwdowns, a new speed regulator, dynamic braking bridge-stop control and automatic discharge magnet control.

A modern ore bridge with electropneumatically controlled motors, use of welded structural steel for cranes and a readily removable worm reduction unit were developments in the crane field.

Unclassified developments included lightning protector tubes, thrustors, Deion breakers and grids, oil-blast breakers, silver-faced breaker contacts, dual overload breakers, remote metering, X-ray and cathode-ray inspection and asbestos-varnish cambric-insulated wire and cable.

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Economy in Power Plant Housekeeping

Washing a few thousand panes of glass in turbine and boiler room walls once or twice a year is the small chore that must be undertaken by the good housekeeper in a modern power station. At the Trenton Channel plant of the Detroit Edison Company there are 25,000 panes that are bathed semi-annually. In the ends of the turbine room are window panels 50 ft. square, each containing 98 rectangles of glass set in light metal casings. Washing these (especially on the outside where swinging stages had to be used) was a huge task and a dangerous one. Inside washing is done from scaffolds built up from the floor of the turbine room.

The foreman of the cleaning crew had a bright idea. It occurred to him that if a few selected panes in each panel were removable men engaged in washing the inside could reach out and wash the outside by merely removing a pane here and there. The idea was soon put into practice. It saves time, labor and eliminates the necessity for outside swinging stages, thereby making the job of window washing much safer. The same principle was applied at other locations where stages had been used.

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READERS' FORUM

Inverted Vacuum Cleaners Make Good Forge

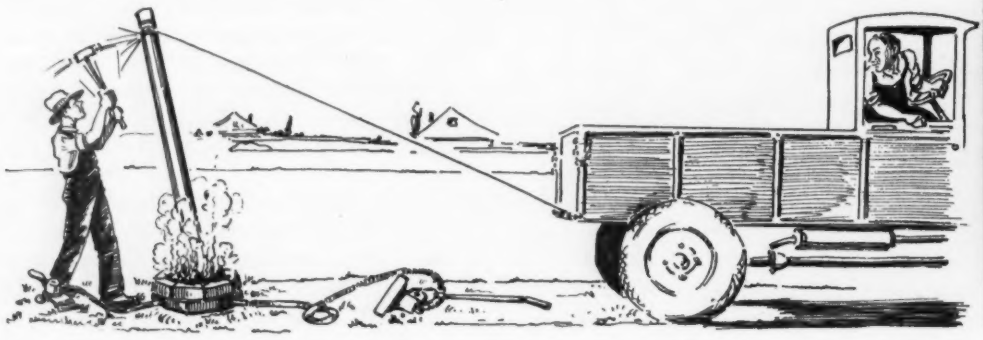
To the Editor of the ELECTRICAL WORLD:

I attach herewith a photograph of a traffic signal which was struck by an overloaded college student's automobile, overload estimated at exceeding 4 per cent.

The pole was 4-in. extra heavy wrought iron pipe, which was mounted in a large and deep block of concrete. The traffic signal itself, as you may see from the picture, was badly broken; in fact, all the shell castings suffered fracture. These were replaced by the manufacturer.

Our own expert, W. J. Dwyer, endeavored to straighten the pipe cold with a pole jack, but was unsuccessful. So he built a small brick fireplace around the pipe, in which he built a coal fire, forced the draught by two vacuum cleaners and soon had the pipe at a white heat. After that he pulled it back to the vertical with a small truck, while an assistant tapped on the pipe with a sledge hammer. Before building the fire the lead-covered feed wires were removed.

R. PHILIP HART,
Cazenovia Electric Company,
Cazenovia, N. Y.



Men of the Industry

J. S. Parker Heads Canadian Electrical Association

John S. Parker, who was elected president of the Canadian Electrical Association, as announced in the June 25 issue of the ELECTRICAL WORLD, is general

manager of the distribution department of the Gatineau Power Company, general manager of the Gatineau Electric Light Company, Ltd., managing director of the Maniwaki Power & Telephone Company with offices in Ottawa. Before assuming the executive duties of these offices in 1927 Mr. Parker had been identified with Knight Brothers Company, Ltd., and with the Hydro-Electric Power Commission of Ontario. He is a member of the Professional Engineers of the Province of Ontario and an associated member of the Engineering Institute of Canada.

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Frank J. Sprague to Receive Tribute

Frank J. Sprague, engineer, scientist and inventor, will be honored, on the 75th anniversary of his birth, for his long service to industry at a meeting of appreciation and tribute to be held July 25 in the Engineering Societies auditorium, New York. Presidents and secretaries of the leading engineering and related societies as well as a large group of other prominent individuals are assisting the anniversary committee, with Gano Dunn acting as chairman. Addresses will be made by Dr. John H. Finley, Frank Hedley and Rear-Admiral S. S. Robinson, U. S. N., retired. Dr. Sprague is known chiefly as a pioneer in the electrical operation of street railways and in the electric elevator field, but his service to the electrical industry has been to all its branches. As a consultant he has been engaged on a variety of engineering problems in the United States and in other countries. At the present time he is president of the Sprague Development Corporation and the Sprague Safety Control & Signal Corporation. In the course of his distinguished career he has been the recipient of the Edison medal of the A.I.E.E., the Franklin medal and the Elliott Cresson medal of the Franklin Institute. He is a past-president of the A.I.E.E., in the affairs of which he has long been active, and holds membership in several other engineering associations.

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C. M. Chapman New President of A.S.T.M.

Cloyd M. Chapman, new president of the American Society for Testing Materials, has had extensive engineering experience in this country and in foreign lands. A graduate of Cornell University, he was employed by Thomas Edison as assistant in his private laboratory for some time. From 1905 until 1920 he was employed by Westinghouse, Church, Kerr & Company, responsible for design and construction work and was engineer of tests. Since 1920 he has been retained as consulting engineer by several companies. He has designed and constructed several important electric generating plants, the first potash plant in America for manufacturing potash from alumite

and several other major developments, including the munition plant at Rock Island Arsenal. He is chairman of the Standards Council of the American Standards Association, a member of several A.S.T.M. committees and a member of other engineering societies.

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E. E. ROBINSON, general supervisor of the Illinois Power & Light Corporation, Kewanee, Ill., has been appointed by Hugh L. Cooper & Company, consulting engineers, to go to Russia for work on the new hydro-electric development on the Dnieper River in Ukrainia. He will be commissioned for nine months to establish operating rules and practices as a member of the advisory staff of American engineers in the employ of Colonel Cooper's organization which had been engaged by the Soviet authorities to supervise the construction of the plant. Mr. Robinson is taking the place of James W. Johnson of Florence, Ala., who is returning to this country because of illness.

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M. B. MERVIS, formerly secretary-treasurer and general manager of the American Insulated Wire & Cable Company, has been elected chairman of the board of the U. S. Magnetic Products Corporation with headquarters in Chicago. Mr. Mervis has been prominent in the electrical industry for more than twenty years.

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JOHN W. GALE has been appointed manager of the Central Massachusetts Electric Company, Palmer, Mass., to fill the vacancy caused by the death of Robert J. Wilder. Mr. Gale had been in the service of the New England Power Association for some years and previously was with Stone & Webster.

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E. R. DAVIS, manager of construction and engineering for the Southern California Edison Company, Ltd., for the past year, has been appointed assistant general manager. Mr. Davis has been associated with the Southern California utility and its predecessor companies since 1896.

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OBITUARY

C. Y. BOWERS, general manager of the Washington Gas & Electric Company, died at his home in Tacoma, Wash., July 7, at the age of 37.

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HENRY L. ZABRISKIE, who had been connected with the Diehl Manufacturing Company for 28 years, died suddenly July 10 at his home in Westfield in his fifty-seventh year. Mr. Zabriskie joined the Diehl organization in 1903 as chief engineer. He was a member of the A.I.E.E.

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THOMAS N. GREER, some few years ago president and general counsel for the Southern Cities Power Company, which was later acquired by the Tennessee Electric Power Company, died at his home in Shelbyville, Tenn., July 10 in his fifty-eighth year. He was for years a dominant figure in Tennessee politics.

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WILLIAM F. BOSSERT, president and founder of the Signal Accessories Company and the organization now known as the Bossert Corporation and long associated in the manufacture of electrical apparatus, died at his home in Utica, N. Y., July 7. Mr. Bossert was 82 years of age.

New Equipment Available

General-Purpose Photoelectric Relay

A general-purpose photoelectric relay with several new and important features has been developed by the General Electric Company. This relay provides more sensitive control than the models which it supersedes and at the same time will permit operation at a minimum light intensity of 3 foot-candles. Other features offered by the relay include improved dielectric strength through the use of a bakelite panel, an improved phototube housing with a cast-aluminum base and a drawn aluminum hood, reduced capacity and leakage due to the use of flexible armored cable between the phototube and the relay proper, thus affording better operation in damp atmospheres. The relay uses a pilotron tube specially designed for industrial purposes.

Because of its many improvements and refinements the relay affords an even wider range of industrial application than its predecessors. Characteristic applications include operation of magnetic counters, control of mechanisms and starting and stopping machinery.

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Soldering Lugs for Standard and Heavy Duty

Soldering lugs which are designed to meet the requirements of light and power company engineers for a standardized line of properly made lugs for standard and heavy duty are announced by the H. B. Sherman Manufacturing Company, Battle Creek, Mich. Standard duty lugs are of substantial construction, providing two bolts each, and are adequate for general purposes, although they will not permit the cable to fuse in case of sustained short circuits. They are furnished only in the long-tongue, two-hole style. The heavy-duty lugs are interchangeable with standard cast lugs and said to be more economical.

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AN ICE MAKER which will produce 192 perfect cubes at a single freezing and is capable of storing 440 more cubes is announced by the Westinghouse Electric & Manufacturing Company. With dual automatic control, it has been designed to freeze ice cubes quickly.

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A LINE OF MERCHANDISING MOTOR PUMPS in sizes from ¼ to 25 hp., good for 5 to 800 gal. per minute, is announced by the Ingersoll-Rand Company, Phillipsburg, N. J. The motor pump is a complete pumping unit with built-in electric motor. Open-type, totally inclosed or explosion-proof motors can be furnished.

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A MIDGET LANTERN which measures 2¼ in. high is announced by the National Carbon Company. It is claimed that it is the first flashlight which uses the new type bulb in which the filament is contained in the base of the bulb, with the top of the bulb acting as a lens. With this bulb no lens is needed other than that built into the bulb.

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Flue Gas Scrubber

A flue gas scrubber based on the principle of removing dust from flue gases by means of multiple films of water against which flue gases must successively impinge during their travel through the scrubber is announced by the Riley Stoker Corporation, Worcester, Mass. This type of scrubber is entirely different from and should not be confused with the use of ordinary water sprays for the purpose of dust removal. The use of films of water instead of sprays greatly decreases the surface of the water exposed to the flue gases and consequently the quantity of water evaporated and carried out of the stack by the gases is greatly reduced.

Welder Unit with Uniform Welding Current

A new welder unit in which a uniform welding current is one of the outstanding features claimed for it is announced by the Lincoln Electric Company, Cleveland, Ohio. By leveling the hills and valleys of the rapid fluctuations of the usual welding current the "Shield-Arc" is claimed to allow the use of a higher average current per given sized rod, which permits a considerable increase in the speed of welding and the amount of weld metal deposited.

The new welder is rated at 40 volts instead of the former 25; thus the machine has a 60 per cent greater kilowatt rating than before. It is built in a.c. and d.c. motor-driven types of 300, 400 and 600 amp. sizes. Removable running gear and drawbar makes a change from a portable to a stationary model very easy.

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Baby Floodlight Has 6-In. Lens

A new baby floodlight which has a lens of 6-in. diameter and can be screwed on a 1½-in. pipe has been announced by the General Electric Company. It can be readily adapted to the lighting of signs or other applications where a pipe mounting is used and it is expected to be particularly applicable in the lighting of signs by gas stations and by sign companies.

The floodlight is designed for use with a 150-watt lamp.

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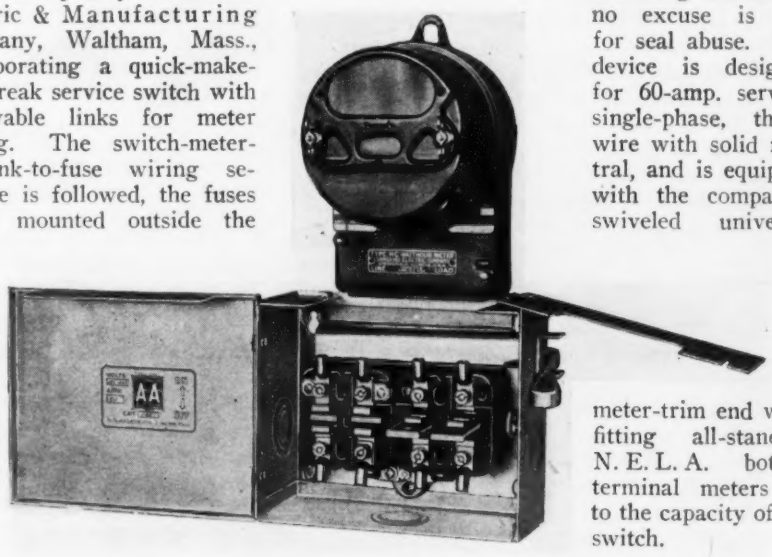
Protects Against Energy Theft

A new combination meter switch and test block has been developed by the Palmer Electric & Manufacturing Company, Waltham, Mass., incorporating a quick-make-and-break service switch with removable links for meter testing. The switch-meter-test-link-to-fuse wiring sequence is followed, the fuses being mounted outside the device and beyond the test link. Inasmuch as the switch thus controls the entire installation, including the meter, no excuse is left for seal abuse. The device is designed for 60-amp. service, single-phase, three-wire with solid neutral, and is equipped with the company's swiveled universal meter-trim end wall-fitting all-standard N. E. L. A. bottom terminal meters up to the capacity of the switch.